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1ST AUGUST, 1975

ENGLISH

FINAL REPORT

~~Technical~~ A TECHNICAL AND ECONOMIC STUDY ON THE [Guyana] FEASIBILITY OF ESTABLISHING A MULTI-PURPOSE PESTICIDE FORMULATION PLANT IN GUYANA y

(IS/GUY/74/013/11-01/05)

MISSION TO GUYANA

9TH MAY THROUGH 1ST AUGUST, 1975

A FEASIBILITY STUDY

BY

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UNIDO EXPERT

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SUMMARY

On the basis of the facts and figures which have been collected, it has been shown that the market in Guyana for ten widely used pesticides, is sufficient to justify the erection of a commercial multi-purpose pesticide formulation complex. The figures also indicate that there is a large potential market in the CARICOM area for these products.

A preliminary lay-out for the proposed formulation complex has been drawn up, the processes have been described and a number of suitable sites selected and identified.

A draft organisation chart has been prepared showing the numbers and qualifications of personnel required to operate and maintain the plant complex including the future chemical control laboratory.

Large deposits of high quality kaolinite have been located at Topira near Ituni. It is expected that production of this material, which appears suitable as a carrier in the formulation process will commence in two years time.

Suppliers of other raw ingredients have been established and specifications established.

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A. INTRODUCTION

In Guyana where the national goal is to feed, clothe and house the nation by 1976; considerable thought and energy is being directed to developing those industries and other resources calculated to contribute to a major extent towards achieving these objectives. In this respect, perhaps the greatest thrust is being directed to developments in agriculture as part of the nation's efforts to become self-supporting in food.

The Minister of Agriculture and his Department have been actively promoting new ideas designed to bring about the desired expansion in this field. One example of the Minister's activities is a programme popularly known as the APD (Accelerated - Agricultural - Production Drive) which looks like having considerable success in its objective of increasing the production of a special set of named crop and livestock commodities. Under this programme, the farmer is asked to increase his crop yields both by adopting improved cultural methods and by expanding his acreage. In this connection, the improved cultural methods consist largely of the adoption of recommended pest control measures.

As part of its programme to attain self-sufficiency in food by 1976, the Government of the Republic of Guyana is planning the establishment of a multi-purpose pesticide formulation plant in Guyana. The project to establish this plant originated at a FAO Seminar on the 'Safe and Effective Use of Agricultural Chemicals' held in Sao Paulo, Brazil from 2nd to 4th May, 1971. At this Seminar, two recommendations concerning Guyana were made.

The first of these was concerned with assistance for building the multipurpose plant which could also be used for the manufacture of Accoushi ant bait; the second dealt with the establishment of a control laboratory that would assist in the registration and standardisation of commercial pesticide formulation.

In January 1974, the present writer undertook a preliminary study on the feasibility of establishing a multipurpose pesticide formulation plant in Guyana. The major conclusions and recommendations were as follows:

a) It is technically feasible to establish the plant in Guyana to serve Guyana alone.

b) A high quality kaolinite has recently been found in large quantities in an accessible area in Guyana which seems to be suitable as a carrier for wettable powder, dust and granular formulations. Solvents, such as white spirit, toluene and xylene which are used in the formulation of emulsifiable concentrates, while not manufactured in Guyana, can readily be obtained from Trinidad which is a member of CARICOM.

c) A tentative list of some eight to ten pesticide formulations has been chosen for manufacture on the plant. This list contains the names of pesticide formulations most widely used in Guyana on sugar, rice and vegetable crops.

d) Working on the principle that the formulation plant should be large enough to be economically viable, yet not so large, as to inhibit the activities of private industry, the plant was designed to have a throughput of 280,000 lbs. active ingredient per working year of

260 days (single shift) based on the Guyana requirements for 1973.

e) This plant would be capable of producing 100% of the dust products, 25% of the wettable powders, and 20.5% of the emulsifiable concentrates required of Guyana in 1973. The plant operating conditions may have to be altered or the size of the equipment scaled up to take care of projected quantities for Guyana to 1980 and for export to CARIFTA/CARICOM area.

The objective of the current project is to carry out a detailed techno-economic study on the establishment of a multi-purpose pesticide formulation plant in Guyana, potentially to service the whole CARICOM Market.

In consultation with the appropriate Government agencies and other interested organisations the expert will be expected to:

1. Survey the current and short term (up to 1980) pesticide demand and export potential.
2. Establish economic plant capacities to meet the agreed demand of Guyana and the potential export demands.
3. Determine availability and specifications of raw ingredients and other technical inputs.
4. Prepare a preliminary lay-out of the plant, describe the formulation process and provide a list of major items of equipment.
5. Assist in site selection for the plant.
6. Prepare a draft organisation chart, including a) the number of personnel required for the operation

and maintenance of the plant, and b) the future chemical control laboratory assisting in the registration and standardization of the commercial pesticides.

7. Recommend follow-up technical assistance by UNDP/ UNIDO as required including tender specification, contracting, the erecting and start-up of the plant.

Having been selected to undertake these duties, the author arrived at Vienna on 6th May, 1975 for two (2) days briefing at UNIDO. The briefing began at 2.30 p.m. in the Project Personnel Recruitment Section with short informative discussions with Mrs. Brennecke and then with Mrs. Sednicek of Personnel Administration Section. The briefing continued in Technical Co-operation Division where the expert was provided with an organisation chart by Mrs. I. Mennel and such basic data concerning UNIDO and Guyana as was likely to prove of value during the mission.

On 7th May, the expert first met Mr. Anguilar - Bolanos, who was acting on behalf of Mr. Triscuizzi, Chief of the Section for the Americas, Technical Co-operation Division. He handed the expert a letter of welcome, from Mr. Triscuizzi (ref. OA 321 GUY 9) which provided information on Guyana including arrangements for local briefing, communications and reports. In view of the experts proposed visits to several of the CARICOM countries, Mr. Bolanos provided the expert with an institutional framework for his assignment as follows:

Institution	Location
Caribbean Common Market (CARICOM)	Georgetown Guyana

Institution	Location
Caribbean Development Bank (CDB)	Bridgetown Barbados
Caribbean Investment Corporation (CIC)	Castries St. Lucia
Caribbean Industrial Research Institute (CARIRI)	Port of Spain Trinidad
Eastern Caribbean Common Market (ECCM)	St. John's Antigua

Because the project had investment potential the expert was introduced to Mr. Habib Khoudja who gave the expert an investment follow-up document to complete.

At 10.30 a.m. the expert met Mr. M.C. Verghese and Mr. K. Szabo. The discussion centered on the best way that UNIDO might help in the special circumstances expected in Guyana. Mr. Szabo will be interested to learn 1) whether agreement will be reached during the experts visit with respect to the setting up of a commercial/demonstration formulation plant. 2) whether the Government would wish to opt for a wholly owned formulation plant in which only technical assistance is provided by UNIDO or 3) whether the Government (while convinced about the desirability of the plant) do not want to take financial or managerial involvement. In such a case UNIDO could possibly assist by arranging technical and financial aid on a bilateral basis.

The expert left Vienna on the afternoon of Wednesday 8th May and arrived at Georgetown, Guyana late on

9th May. On the morning of 10th May he met Mr. Alexander Simon (United Nations Resident Representative a.i). During the short discussion that followed, Mr. Simon expressed the view that the mission was complex and as such would normally require a longer period than the 3 months which had been assigned to the mission. He felt he would like to keep in close contact with the expert over the period of the mission.

It will be self evident from the above remark that the Ministry of Agriculture is well aware that insects/diseases are an ever-present threat to most crops and average yields are more or less continuously depressed by attacks which cannot be effectively controlled under prevailing farm conditions.[1] As part of his duties the expert will endeavour to seek views as to whether the installation of a local pesticides formulation plant will prove more effective in combatting this threat than the present supply methods.

The persons and institutions contacted are shown in Annex 1.

B. FINDINGS

1. THE PAST AND PRESENT DEMAND AND EXPORT POTENTIAL FOR PESTICIDES

As no published report, including the Terminal Report of El Sharawy [2], contained detailed information concerning the annual volume and value of the individual pesticides imported into Guyana and the other territories comprising the Caribbean Community (CARICOM), the expert considered that the compilation of such data was a pre-requisite to establishing the economic plant capacities necessary to meet the Guyanese demand and the potential export demand.

As stated in the experts earlier report [3] the major outlets for pesticides in Guyana were Rice and Sugar crops. Other outlets were spread over a wide range of crops with an increasing outlet being for ectoparasite control on cattle.

1.1 Pesticides purchased for distribution in the Rice Growing Industry in Guyana

The Guyana Rice Board is responsible for the purchase and distribution of pesticides and equipment used in pest and disease control programmes and for the repairs, maintenance and issuing of spraying equipment. Table 1 lists the pesticides by volume and value purchased for 1969 - 1975. The prices shown give the cost price paid but pesticides are sold to rice farmers at a subsidised price equivalent to 50% of the landed cost. (N.B. there are two crops per annum).

1.2 Pesticides purchased for distribution in the Sugar-Cane Growing Industry in Guyana

Sugarcane is by far the most important crop of Guyana's economy. The acreage under cultivation being 107,000 in 1970 and 130,420 in 1972. In 1970, the majority of the acreage (about 92%) was owned by large estates. The remaining acreage (owned by small farmers) is increasing year by year.

Table 2 lists the pesticides by volume and value purchased for 1969 - 1974 by Bookers Sugar Estates Ltd. and the Demerara Company Ltd.

1.3 Agricultural Chemical Usage in the West Indies Sugar Industry [4]

In order to determine the types and quantities of agricultural chemicals used in regional cane cultivations a survey was recently carried out by means of a questionnaire. In addition, discussions on regional sales of these chemicals were held with representatives of several of the major companies engaged in this field. Of particular interest were those chemicals which could have the potential of leaving undesirable residues in - (a) cane tops used for animal fodder; (b) raw sugar or (c) molasses.

Response to the survey was excellent and it is considered that the data shown in Tables 3 and 4 are a fairly accurate representation of usage of agricultural chemicals in the West Indies Sugar Industry for 1972.

In the list of herbicides in Table 3, the current situation is that the residual and selective triazine

and asulam/ioxynil pre-emergence herbicides are replacing less selective, though cheaper, contact chemicals such as dalapon, sodium chlorate, sodium trichloracetate and daconate. It is evident that, with rising labour costs and availability of weeders, the use of "once-for-all" treatments is increasing considerably. Despite this, labour costs for hand weeding still accounts for over 50% of the total expenditure on weed control in Guyana, - to some extent this is due to social considerations. Elsewhere, in ridge and furrow or Louisiana-type layouts weed control is generally carried out by chemicals rather than mechanical methods.

The growth inhibiting effects of dalapon on cane, if great care is not taken to avoid foliar contact, led to the use of the more selective DCMA herbicide. In turn this was wrongfully held suspect as a potential source of arsenic residues and is not now used on crop areas. As intra-row (- as well as inter-row) herbicide action is essential for selective contact chemicals, asulam, which underwent extensive screening in the West Indies, is gradually replacing these herbicides. For pre-emergence application, 2.4-D is still the most widely used herbicide although increasing use is being made of ioxynil formulations.

The organo-mercurial fungicide PMA (phenyl mercuric acetate) is largely being replaced by benomyl for pre-planting treatment of seed-cane material. This chemical does not have the residual environmental hazards of PMA. Along similar lines, the relatively

non-toxic triazines are replacing pentachlorphenol for aquatic weed control in Guyana.

All the W.I. sugarcane countries have reported varying degrees of varietal susceptibility to triazine, substituted urea and asulam formulations. In particular B.41227 exhibits foliar scorch and growth inhibition following undirected or poorly supervised spraying. A screening programme for herbicide and commercial varietal interaction is most desirable but would impose a further load on the plant breeding selection programme.

The relative importance of pests of sugarcane in the West Indian region is reflected in the use of insecticides and rodenticides in Table 4.

In Jamaica, the W.I. cane fly (Saccharosydne sp.) and jumping borer (Elasmopalpus sp.) are major problems and this is reflected in their usage of malathion. In Trinidad, the high incidence of froghopper (Aeneolamia sp.) necessitates the use of a wide range of both foliar, and soil applications, of organophosphate pesticides. In Guyana this pest is largely controlled by BHC dusts - although malathion is used for aerial control of the adult stages of this pest. No build-up of resistance to BHC has been observed in Guyana - as occurred in Trinidad, although a different species is involved. Although the stem-boring Diatraeas' are major pests throughout the region, chemical control is practised on a limited scale due to overlap of generations and absence of population peaks. Azodrin

and granular Endrin are generally used. For control of leaf-eating caterpillars there is a trend towards replacing the residual organo-chlorines like endrin with less persistent but effective organo-phosphates such as dipterex.

All countries with the exception of Guyana report use of Warfarin for rodent control of Rattus sp. In Guyana the indigenous Holochilus sp. is resistant to this rodenticide and endrin, thallium sulphate and zinc phosphide baits are used. Much emphasis has been placed on habitat management for control of this pest.

In the light of environmental considerations, use of agricultural chemicals by the West Indies sugar industry has been minimal and traditionally cultural and biological control methods are generally practised.

1.4 Pesticide usage in Jamaica

The introduction of DDT into Jamaica was followed closely by other chlorinated hydrocarbons such as Benzene hexachloride, Chlordane, Dieldrin and Aldrin in the early 1950's and by 1955 Dieldrin was the insecticide recommended for control of the banana borer (Cosmopolites sordidus) and Fiddler Beetles (Pachnaeus and Exopthalmus spp) the latter affecting citrus roots. Chlordane was recommended for the control of many soil pests but its greatest use has been for the control of termites in the soil and in the buildings.

Agrocide and Lindane (forms of BHC) were also introduced in the 1950's and are still being used to

control agricultural pests, although they have been largely replaced by Malathion. Some of the bad features of the chlorinated hydrocarbons are that they persist too long on plant materials or in the soil and also kill beneficial insects.

The phosphatic insecticides such as Malathion, Rogor, Dipterex, Basudin, etc were introduced in the late 1950's and early 1960's some of them were found to be safer for use on vegetables and fruit crops as they killed the pests and dissipated quickly - within a few days.

By early 1960 a tremendous amount of new pesticides became available on the local market and a committee was set up to advise the Drugs and Poisons Control Board of the Ministry of Health on matters related to pesticide importation, sale and use in the island. That Committee is still in existence.

At present there are over 500 different formulations of pesticides approved for sale in Jamaica most of those however are mixtures for garden or household use. It is estimated that not more than 50% of these are in regular use. Great care is exerted by the Drugs and Poisons Control Board to approve only relatively safe concentrations of insecticides for sale to the public as Aerosols in supermarkets and shops. Most of these aerosols contain pyrethrum or pyrethrins (for quick knock down of insects), as active insecticide (such as that in Malathion, Diazinon, Baygon or Chlordane) and a carrier, usually petroleum oil.

In Jamaica at present the most commonly used

agricultural insecticide is Malathion. It has a broad spectrum activity, gives a good and quick kill of many pests, is fairly safe to apply and dissipates quickly leaving no harmful residues after 2 to 3 days. Other phosphatic insecticides commonly used are Diazinon (Basudin), Dipterex, the Dimothoates (Rogor, Cygon, Perfekthion) Gardona and Metasystox R. Parathion a very toxic phosphatic insecticide is not allowed into the country.

In addition to the Chlorinated Hydrocarbons and Phosphatic insecticides there are the carbamates which include chemicals such as Sevin and Baygon.

Sevin is largely used for the control of caterpillars, e.g. the ones damaging cucurbits and ornamentals, but there is evidence that a number of insects have developed resistance against it in Jamaica and other parts of the world. Baygon is not recommended for application to plants but is largely used as a household insecticide.

The matter of resistance of insects to insecticides is a serious problem. In Jamaica several pests that were previously easily controlled with an insecticide are now resistant e.g. Banana-borers are apparently now resistant to Dieldrin; the caterpillars of the Diamond back moth on cabbages are not controlled by Malathion or Sevin; some caterpillars on callalu are not controlled by Sevin or Malathion.

Present use of fungicides in Jamaica

During the 1940's and 1950's Bordoaux mixture was the

most popular fungicide in Jamaica with Perenox a Copper oxide compound also occasionally used. Since the discovery in the late 1950's that petroleum oils can control banana leaf spot disease and since the advent of the single mix coppers Bordeaux mixture is rarely applied.

At present the single mix neutral copper fungicides such as Cupravit Blue and Kocide are very popular and effective against a wide range of leaf and fruit diseases. They are easy to mix, remain in suspension for a long time and are compatible with most insecticides.

The introduction in the mid 1950's of the dithiocarbamate fungicides such as Thiram, Zineb, Maneb and the Dithanes did a lot to improve the control of some diseases such as late blight of tomato and potato and rust of pimento and some other crops. More recent introductions of fungicides such as Daconil (Bravo) or Difolaton have also given the farmer additional useful fungicides. Captan and Dexon are soil fungicides that have proven useful.

The most important discovery in the fungicide field, however, is that of the systemic fungicides which are capable of being absorbed by the plant and exert protective or curative effects against certain diseases that were previously difficult to control. The most important of these systemic fungicides to date is Benomyl (Benlate). It has been found to be very effective against a number of fruit rots of bananas, anthracnose of mangoes, citrus and other fruit trees, powdery mildews, scab on citrus and a number of leaf diseases. Unfortunately

Benomyl has shown little or no effect against the downy mildew group of fungi e.g. those causing black pod of cocoa, late blight of tomato and potato and downy mildew of cabbages and cucurbits or the rusts.

The Use of Weedicides in Jamaica

The most commonly used chemicals for weed control in Jamaica are the so called "hormone weed killers" which are compounds of phenoxy acetic acid e.g. 2,4-D 2,4,5-T and MCPA. These compounds are widely used to control broad leaf weeds in sugarcane fields and in pastures. They kill the majority of broad leaf weeds by their selective systemic action. It has been shown that their activity depends on oxidation by enzymes in certain plants, consequently the phenoxy acetic acids are harmless to those plants not containing enzymes capable of degrading them by certain oxidation processes.

Other important weedicides being used in Jamaica are Paraquat (Gramoxone) dalapon (Dowpon, Gramevin, Dalspray and Basfapon) the Triazines (Simazine, atrazine, prometryne and Gesagard) Tok, Diphenamid and Propanil (Stam).

Paraquat (Gramoxone) is a contact weedicide and quickly kills all green material on which it is sprayed. Next to the 2,4-D's this weedicide is the most largely used in the island. It is applied through crops such as bananas, citrus, coconuts, coffee, other tree crops, vegetables, legumes, root crops etc. It is quickly inactivated on contact with the soil.

The Triazines are largely soil acting weedicides and

are usually applied prior to planting to prevent weed growth for several weeks or months in a young crop.

At present weedicides are being manufactured and marketed at a much faster rate than other pesticides and new weedicides appear frequently in Jamaica. Over 100 different formulations are now available on the local market.

The Use of Nematicides in Jamaica

Nematicides are a group of pesticides that are becoming increasingly important. Most of these are fumigants that kill nematodes in the soil either before a crop is put in or after it is established. Some of the nematicides in use in Jamaica are DD, DBCP (Nemagon), Methyl Bromide and Nemacur.

Great care has to be taken with the use of these chemicals so as not to affect the crop plant adversely. If properly used, however, they can assist in improving the growth and yields of many crops. Bananas for example are often severely affected by the burrowing nematode Radopholus similis which can cause extensive root damage and lead to great reduction in yields.

Vegetable crops (particularly tomato, carrots, cucurbits, celery and cabbages), also pineapple and bean plants are very susceptible to nematode attack. Soil treatments with approved nematicides usually lead to increased growth of susceptible crops and better yields.

1.41 Volume and Value of Annual Demand for Pesticides in Jamaica

Using datasupplied by the Department of Statistics

and the Agricultural Planning Unit, the Plant Protection Division provided UNDP with the following information. Due to shortage of time it was not possible to sub-divide the figure further to provide information about the pesticides used.

Table 1: Imports of Selected Chemicals into Jamaica (1971-1974) (Source: Dave G. Hutton and A.G. Naylor, Ministry of Agriculture, Kingston)

Chemicals	1971		1972		1973		1974	
	Volume Met.Tons	Value Ja $	Volume Met.Tons	Value Ja $	Volume Met.Tons	Value Ja $	Volume Met.Tons	Value Ja $
Herbicides	512.3	718,940	555.9	750293	226.7	400,281	1007	1562244
Insecticides	682.6	864,331	844.0	867594	860.0	224,915	789.2	112202
Fungicides	113.4	171,585	207.2	242831	328.3	604,491	173.1	28867

Table 2: Projected Quantities (Metric Tons)

Chemicals	1975	1976	1977
Herbicides	724	905	1,041
Insecticides	1,584	1,900	2,263
Fungicides	543	697	815

Note: To date herbicides have been used in connection with the following main crops: Sugarcane, banana, vegetables, pasture coconuts, citrus. In future it is anticipated herbicides will also be used on tobacco.

To date insecticides have been used to protect the following major crops: Banana, vegetables, sugarcane, citrus, coffee, cocoa, root crops & tobacco.
To date fungicides have been used to protect the following main crops: Vegetables, banana, cocoa, citrus and root crops.

1.42 Estimated volume of 1970 demand for pesticides used on individual crops in Jamaica

The expert is indebted to Mr. Alvin A. Thompson of the Caribbean Chemicals & Services Ltd. who provided the data shown in Annex 2 Table 5. This includes an estimate of the volume of individual pesticides used on named crops for 1970 together with total figures of pesticides on these same crops for 1971, 1974 and 1975.

1.43 The Control of Banana pests in Jamaica.

Mr. Walker of the Banana Board, Jamaica recommended the use of dibromochloropropane (DBCP) for the control of nematodes on Banana. The material was difficult to apply (soil injection) and it had proved difficult to attract labour for this task. Recent wage increase caused Mr. Walker to hope that manpower would now become available to carry out this task.

Recently he had ordered 12 tons of the newer nematicide granules eg. Nemacur 10%, Furadan 5% and Mocap 10% but the cost of the technical material is three to five times that of DBCP based on technical content alone.

If Mr. Walker's recommendations are now followed 70,000 gins of DBCP should be applied per year whereas to date only 3,152 gins. have been applied. There are 13,000 - 14,000 acres which should be treated with a nematicide.

Banana Weevil Borer is being controlled by the

application of 50 - 60 lbs/acre of Chlordecone 5% dust sprinkled around the base of the plant (Kepone 5% dust ex Allied Chem. Corp. Agric. Div. NY.). Records show that ¼ million lbs is used over a 12 month period.

Benomyl is being tested in conjunction with Banana Spray Oil for the control of leaf spot on Bananas. If successful 1½ lbs of Benomyl 50% wettable powder would be required for each of the 70,000 acres under cultivation in Jamaica = 105,000 lbs of Benomyl wettable powder.

The use of oil would still be necessary but the number of cycles (1 cycle = 1 gallon) of oil would be reduced by 6 namely from 17 to 11. (N.B. The aircraft is calibrated to deliver 1 gallon of oil per acre)

Paraquat is the most widely used herbicide being applied at the rate of 1½ pints/acre. Dalapon is also widely used.

1.44 <u>The views of Senior Officials of the Ministry of Agriculture, Kingston, Jamaica on the export prospect of the Guyana Formulation Plant</u>

In discussions on 4th July, 1975 with Mr. A.G. Nayler (Director of Crops and Soil Department), Mr. Van Whervin (Chief Plant Protection Officer) and Mr. George Corrie (Secretary of Drugs and Poisons Control Board) the following points were made:-

1. The Guyana plant would seem to be a worthwhile effort.
2. We will gladly accept the product providing the quality of the formulated

products are equal or better than the present standard and the price is the same or only marginally higher.

3. Although labour rates are lower in the Caribbean than Europe or U.S.A., locally produced products usually end up more expensive than their imported equivalents. This is because local production is so low.

4. The trading policy of CARICOM is to protect locally manufactured products.

5. It is possible that manufacturers may artificially increase the price of the technical pesticides to the plant to compensate for losses incurred by their distributors in the various territories. To avoid this occurring it is important to ensure that a fair deal is worked out very carefully to ensure that the legitimate interests of all parties are taken into consideration.

6. Want the plant to offer relatively safe pesticides.

1.5 <u>Pesticide Usage in Trinidad and Tobago</u>

Discussions took place on 24th June, 1975 at the Ministry of Agriculture, Central Experimental Station, Centeno, Arimo, Trinidad with the

following:-

Mr. Winans Bishop, Dr. R.M. Barrow

and Mr. Gordon A. Lawrance.

A wide range of pesticides are used in Trinidad and Tobago which as the figures for total imports Annex 2 Table 6 show rank next to Jamaica in importance as an importer.

At present there are no regulations on the use of pesticides but a draft Pesticides and Toxic Chemicals Act is ready for submission to Cabinet together with regulations on licencing of pesticides which may be passed at the same time.

Mr. Bishop mentioned that the same pesticide is used under different trade names, sometimes mixed together with the user being unaware of their identities. It was this ill usage which had given rise to the idea of the Commonwealth Caribbean Pesticides Control Unit which is located at the University of the West Indies, St. Augustine, Trinidad. The Unit has carried out much useful work on residue and formulation analysis while the Director Dr. R.G. Gibbs gives frequent talks on the safe use of pesticides to Extension and other Ministry of Agriculture Staff.

With respect to the Guyana Pesticides formulation plant, the Trinidad officials were convinced that the need for the plant exists but considered the economics more doubtful. He said that Joe Pirez of Caribbean

Chemicals had considered setting up a formulation plant in Trinidqd but he understood he had given up the idea.

1.51 Attempts to obtain information on the pesticides used in the Sugarcane growing Industry in Trinidad and Tobago

In order to obtain data on the actual annual amounts of individual pesticides used in control of pests and diseases on Sugarcane in Trinidad and Tobago, the expert contacted Dr. Tommy Carr of Messrs Caroni Ltd. on the telephone and finding an engagement with him was not possible, the expert wrote to Dr. Carr on 25 June 1975 asking for the desired information covering the years 1969 to 1974. To date 18 July, 1975 this information has not been received.

1.6. Pesticide usage in Barbados

The volume and value of pesticides imported into Barbados over a number of years (1969 - 1974) is shown in Annex 2 Table 7. A study of the figures in comparison with those of the other territories enables some idea of the potential size of the export market to Barbados to be made.

On the 27th June, the Ministry of Agriculture arranged an informal meeting with officials of the Ministry of Agriculture, Industry and Commerce. The following points were made.

a) The products to be formulated, should be selected from those used on a regional basis.

b) The formulated products must be as good in quality (if not better) than those currently sold.

c) The price of the product to farmer must not increase as a result of local formulation.

d) How will decisions to change the formulations produced be made, to keep up with changing needs.

e) There is no requirement for an ant bait in Barbados.

1.61 Caribbean Development Bank's interest in Plant

Mr. Lewis G. Campbell, Head of Agriculture Division said he was interested in the project because there were shortages under the present system which also failed to provide adequate technical services. The Caribbean Development Bank was making efforts to set up farmer owned organisations in the territories and he felt that it would be possible to link the Guyana Pesticides Formulation Plant with the scheme in some way. If this co-operation develops, it would be possible to take some equity in a distribution system.

Mr. Campbell suggested that the scheme be put to the Ministers of Agriculture at their next joint meeting and just as they have agreed in principle for those pesticides which come from outside Caricom so they could consider the new situation of a plant inside the Caricom area.

There is scope for the Bank to be involved in the financing of the development of the plant if it is so wished. The need for having reliable supplies of pesticides

for Agriculture are well recognised and the Caribbean Development Bank's operations will depend to a large extent on satisfying these needs.

One of the functions of the Caribbean Development Bank is to provide support services for the productive centres (including agriculture) and a project of this nature which if found to be viable financially, technically and economically is one which could meet Caribbean Development Bank support. The Caribbean Development Bank is actively persuing the organisation of services and facilities for the adequate distribution of chemicals for Agriculture in the Eastern Caribbean and this could be integrated with the development of a Chemical Supply Operation such as this pesticide formulation plant will be.

1.7 Pesticide usage in St. Lucia

Mr. Cecil Wooding, Permanent Secretary, Ministry of Agriculture expressed much interest in the formulation plant. He said he would endeavour to collect the required information and send it to me.

1.71 The control of Banana Pests in St. Lucia.

On the 30th June 1975 during a discussion with Mr. Simon Gage, General Manager of the St. Lucia Banana Growers Association, he said that DBCP has been applied by injection for many years but difficulties arise under dry weather conditions. The new nematicides are effective but

more costly. If the cost permitted the average grower would prefer to apply granules. In this respect the Guyana formulation plant could assist in reducing prices by eliminating long haulage charges.

With respect to corn borer control some resistance to heptachlor and dieldrin is suspected and the Ministry of Agriculture is to start a survey in this connection. Mr. Gage said that the following quantities of pesticides were used in St. Lucia on the Banana Crop.

Pesticide	1972	1973	1974
Banana Spray Oil	240,000 gln	240,000 gln	240,000 gln
Heptachlor 2% dust	139 tons	95 tons	95 tons
Aldrin 40% EC	216 gln	141 gln	385 gln
DBCP 75%	5,600 gln	4,700 gln	1,500 gln

Mr. Gage said that they had been using less pesticides than they should have been using because of financial reasons.

1.72 Control of Banana Pests in the Winward Islands

During a discussion with Dr. Joseph Edmunds, Director of the Windward Islands Banana Growers' Association

(WINBAN) at St. Lucia on 30th June he mentioned that Bayer were considering formulating Nemacur granules at Guadeloupe and that Nobel were considering fromulating Mocap at Martinique. It seemed feasible to the writer that both firms might be interested in having their products formulated at the Guyana Plant and the interesting thought arises that companies may wish to have their newer ant baits and nomatocides formulated in Guyana on a contract basis. This idea could be explored later if it fits in well with the Government's plans.

With respect to the pesticides currently being considered for manufacture on the Guyana Plant, Dr. Edmunds said that only the Triazine 80% wettable powders, aldrin and dieldrin Emulsifiable concentrates were used in the Windward Islands (but not St. Vincent) whereas Banana spray oil was widely used.

The use of weed killers in the Windwards is now widespread and the days of laborious mechanical weed control methods are over. Weedkillers may be used:

a) Before planting. Starting from land originally under forest, the trees may be killed by a basal application of (2, 4-D + 2,4, 5-T) at the rate of 2 gallons in 100 gallons of kerosene.
If the land had previously been under cultivation, the chemicals to use before planting are 2, 4. 5 - T for bush control and dalapon for grass control.

b) Pre-emergent weed control. Soon after planting one of the following residual weedkillers is recommended at the rate of 2 - 3 lbs. of active ingredient in 20 to 40 gallons of water per acre.

1. Diuron
2. Atrazine or Gesaprim
3. Simazine or Gesatop
4. Linuron
5. Chlorbrommuron

c) Pre-emergent weed control. For spot spraying under banana plants to control limited weed growth, paraquat, at the rate of ½ fluid oz. per gallon has given good results.

Discussions also took place with Mr. S. Gowan and Mr. Graham Michell.

1.8 Pesticide usage in Antigua

During a discussion on 1st July at the Ministry of Agriculture, St. John's, Mr. John Hardie said that in the past Agriculture in Antigua was a sugar based industry. It got into severe financial difficulties several years ago and then collapsed. Sugar is no longer grown. The last crop was in 1972. No agreed plan has been settled for the but it would include cotton, maize (500 acres) and other grain crops, grass for grazing, oil seed, vegetables, tree crops, pineapples, 2000 acres of vegetable and food crops (sweet potatoes, edoes grown at a low level of chemical treatment). At present he would guess that 15% of the 2000

acres was being sprayed say 300 acres .

They were trying to introduce Sea Island cotton but so far only 600 - 700 acres have been introduced and it is not sure whether this industry will survive.

Quantities of pesticides sold to farmers by the Agricultural Extension Service, Marketing Depot. 1973

Carbaryl	4,188 lbs
Toxaphene	660 gal
Diazinon	17 gal
Malathion	83 gal
Paraquat	64 gal
Diquat dibromide	13 gal
Dithane	30 lbs
Trichlorphon	748 lbs

1.81 The control of cotton pests in Antigua

Mr. N.S. Irving said that when DDT went out they started to use toxaphene and endrin against cotton pests. Recently they had used carbaryl against leaf worm of cotton while malathion had been used or ULV. As the wind always blows steadily from the same direction the Ulva sprayer and the Aero Ulva have been used with success. The shortage of water has given a boost to ULV. Mr. Irving considered the Guyana Plant would be useful because at present many pesticides were not available in Antigua.

1.82 The East Caribbean Common Market Secretariat, Antigua

Mr. George Williams, Executive Secretary, said that on request from the United Nations the Secretariat could act as an agent on behalf of the U.N. to collect all data required regarding pesticide usage. It would require a special organisation within the Secretariat to do this and the task of this organisation would be to ask Government in the various territories for the information required.

Finally, he said the organisation was not set up on a statistical basis at the present time.

2. THE ECONOMIC PLANT CAPACITIES TO MEET THE AGREED DEMANDS OF GUYANA AND THE POTENTIAL EXPORT DEMANDS

The establishment of a local pesticide formulation plant providing for agricultural requirements and using domestic resources such as mineral diluents and labour force, could result in a substantial reduction in foreign exchange requirements in cost of products to the user by savings in distribution and transportation costs and in delays in deliveries. Additional economic advantages would derive from generating associated industries such as the exploitation and processing of mineral fillers, increasing employment and achieving better pest control.3/ The establishment of the plant should also encourage the development of scientific technological and manufacturing skills which should prove of considerable value to the community.

2.1 Selection of pesticides to be formulated on proposed plant

In ascertaining the economic feasibility of the plant, one has to be satisfied that the products can be formulated more cheaply than they can be bought. That is to to say all products formulated should be profit makers and should not lose money. From time to time, various commercial firms have considered erecting a formulation plant in the Caribbean area but to date none have done so presumably for economic reasons. However, by selecting some 8 to 12 formulated products which have hitherto been imported as formulated products by the various chemical companies in the largest amounts, it would appear 3/ that the plant in Guyana

should be large enough to be economically viable, yet not so large, as to inhibit the activities of private industry.

It is understood that the Government is actively pursuing the development of new crops not traditionally cultivated in Guyana e.g. cotton, cassava, soyabean and maize. Therefore partly for this reason and partly because of new pest problems in the traditional crops, it may be that in due course these 8 to 12 formulations may not in themselves be sufficient to provide adequate control. If and when this proves to be the case, it is expected that experimental work in Guyana and the other territories will suggest new pesticides which can be used either alone or in blends with the above-mentioned to provide the desired results.

It is now intended to size the Formulation Plant, but before this can be done, it is necessary to work out the annual demand for individual pesticides in Guyana (1969-1975) with projected demands (1975-1980).

The annual demand for the years 1969 to 1975 (Annex 2 Table 8) has been obtained by adding the figures for sugar and rice (Annex 2 Tables 1 and 2) to establish a user record over the past five years. On inspection, considerable annual variation was found in this user record due partly to difficulties in obtaining regular and reliable supplies of pesticides and partly due to irradication campaigns mounted by the Sugar and Rice Authorities. Consequently it was decided that it would not be possible to work out reliable projections based

on this user record because no regular pattern of usage had emerged.

A procedure for estimating future pesticide demands in Guyana was agreed during discussions with Messrs. Bookers Sugar Estates Ltd. and the Guyana Rice Board.

In the case of sugar, the expert was advised that the total annual demand for insecticides would not change over the forthcoming five years (1975-1979), apart from a small annual increase (10 percent) in 13 percent gamma BHC demand. The demand for triazines was expected to reach 130 tons in 1975, and a maximum of 150 tons in 1976, after which it would remain constant.

In the case of rice, the expert was advised that the demand for monocrotophos and fenitrothion formulations were expected to increase from 1975 by 50 per cent per annum. The demand for propanil was expected to increase annually by 30 per cent. In the cases of trichlorphon, aldrin wettable powder, dieldrin EC and carbaryl wettable powders, the annual demand was expected to increase by 10 per cent.

These figures were then used to calculate the projected figures for sugar and rice for 1975 - 1980 (See Annex 2 Table 8) but before this was done, a single increase of 15 per cent was included in the sugar and rice figures (based on the annual figure for 1974/1975) to take into account, the increased pesticide usage on

'other crops' arising as a result of the Governments current Accelerated Production Drive.

2,4-D amine salt, is currently being manufactured at established plants namely Bookers Sugar Estates Ltd., (Ogle) and the Demerara Sugar Company, plant at Farm. The expert sees no reason to suggest changes in these arrangements.

Rodenticide pellets have been and still are manufactured at Bookers Ogle Plant. The expert considers that this area presents a toxic hazard to operators and should be redesigned and incorporated in the new formulation plant.

2.2 Sizing the Plant in terms of Volume of Pesticides and Major Items of Equipment

In order to size the Plant, the 1975 and 1980 annual demand figures, have been taken into consideration (Annex 2 Table 8). These figures show the volume of the ten pesticides and three rodenticides , to be formulated.

The size of the Major Items of Equipment was derived by first grouping the formulations which can be processed on the same equipment and then indicating the total volume of Product to be processed for each of these Groups. From this information and the through puts of major item of plant involved, the time was calculated to carry out this operation. It will be seen (Annex 2 Table 9) that the size of the equipment employed was adequate to carry out these operations in a reasonable time. The size of the

equipment employed is given below:-

Mill A	- Throughput - 500 lbs per hour
Mill B	- Throughput - 500 lbs per hour
Jacketted Pan C	- 80 glns working capacity
Ribbon Mixer D	- 2240 lbs batch capacity at density of 40/50 lbs per cubic foot.
Pelletor E	- Output - 500 lbs per hour.

2.3 Guesstimate Price of Formulation Unit

In a private communication dated 10th July, 1975, Messrs. Sturtevant Engineering Co. Ltd, Hamlyn House, Highgate Hill London N 19 5PP, state that with respect to the Insecticide and fungicide dust concentrate wettable powders and dust plant they would guesstimate that the price of a unit capable of 500 lbs of either dust concentrates and wettable powdom and also capable of producing 1 ton per hour of field strength dusts will be in the order of £30,000.

With respect to an emulsifiable plant the cost will depend on the amount of local work the client would wish to undertake. At a broad guess, and in the absence of detail, a plant of some 400/500 tons per annum could be in the order of £18/20,000 complete.

3. AVAILABILITY AND SPECIFICATION OF RAW INGREDIENTS

3.1 Technical pesticides: These are available from the manufacturers or their accredited local agents. It is recommended that FAO specifications be adopted both for the technical pesticides and for the formulated products.

It is the policy of most if not all pesticide manufacturers to co-operate with Governments not only in the sale of technical pesticides but in providing them with technical information concerning both the formulation and the analysis and testing of the products.

3.2 Kaolin and other dust diluents and carriers

Kaolin deposits are known in many parts of Guyana but those which have commercial possibilities at the present time occur in association with the bauxite deposits of the accessible coastal belt.

Together with the Commissioner of Geological Surveys and Mines Department and Mr. Fritz Weihrauch a Geologist, the expert visited Topira which is the name of an old bauxite mine and now the name of the Kaolin deposit. It is 1½ miles to the south of Ituni which is 32 miles south from Linden. Linden is in turn 72 miles south of Georgetown.

The Kaolin 3.2/ occurs as a ban extending from North to South direction and originally lay beneath the Bauxite which has been removed.

The Kaolin is a Kaolinitic material which contains about 70 per cent Kaolinite on average, about 25% quarts and 5% muscovite with some heavy minorals

Chemically

Loss on ignition	12.5%
SiO_2	50%
Al_2O_3	35%
Fe_2O_3	1%
TiO_2	1%
CaO	0.3%
MgO	0.2%

Particle size of raw material

+ 63u	approximatoly	25%
+ 15u	"	45%
5u to15u	"	25%
less 5u	"	35%
less 2u	"	32%
less 0.63u	"	20%

According to proliminary plans the plant shall produce

Coater paper grade	less 4u
Filler paper grade	less 14u
Ceramic grade	less 30u

It was agreed that investigations should consider the most suitable particle range for the pesticide industry as being +14u. Pending the results of the investigation, which would take some time, it was agreed to use the "less than 14u grade" until further notice assuming milling, trials

(see below) prove successful .

On the basis of the present information it is hoped that the kaolin plant at Topira will come on stream in 1978. It is expected that a few hundred tons of the kaolin grades will become available in the first half of 1976. It is recommended that UNIDO should let the Geological Survey and Mines Department (Mr. Hopkinson) know in due time what quantities will be required for milling trial purposes.

Kaolin Reserves (Ituni)

The expected kaolin reserves are as follows:-

1) Topira Mine: 2 million metric tons proven
2) Warababara Mine: 0.6 million metric tons proven
3) Block 18 Mine: 0.8 million metric tons probable
4) Block 19 Mine: 0.2 million metric tons probable
5) Kamababra Mine: 0.1 million metric tons proven

The raw materials which complement kaolin are feldspar, ball clay, talc, and silver sand. The Surveys Department has located an estimated 10,000 tons of feldspar from pegmatites in the stone quarries around Bartica; several million tons of ball clay near Tumatumari; and over 6 million tons of talc - soapstone material at Kauramembu in the North West District. The supply of silver sand in the coastal belt is unlimited.

Examination of sample of Kaolin from the Topira Deposit

The sample of Kaolin referred to in the expert's earlier report 3/ was examined by Messrs. English Clays Lovering Pochin and Company Limited in comparison with a sample of clay which is sold for the formulation of Pesticides. The results are shown in Annex 2 Table 10. These show that the Itumi clay should be quite satisfactory as a carrier.

3.3 Solvents

Suitable solvents for the formulation of pesticides are manufactured in Trinidad but not in Guyana. Experience has shown that it is essential that only recommended grades of solvents be used on the formulation plant if the liquid products prepared from them are to comply with FAO specifications (as recommended by the Expert).

It has been found that suitable solvents for the formulation of most emulsifiable concentrates (EC) are xylene and Shellsol A. For water soluble concentrates (WSC) suitable solvents are hexylene glycol and acetone. Suitable specifications and suppliers for these solvents are mentioned below:

3.31 Xylene

The xylene used on the plant must at least comply with the specification for American 9° xylene (Marsden Solvent Guide p557). Grades of xylenes complying with more rigid specifications are also acceptable. This grade is available

from the following:

Texaco Trinidad Ltd.
Colonial Life Building
29, St Vincent Street
Port of Spain, Trinidad.

TRINTOC (Trinidad Tobago Oil Co Ltd)
Salvatori Building
Frederick Street
Port of Spain, Trinidad.

Shell Antilles and Guyanas Ltd
High Street
Georgetown
Guyana.

3.32 Shellsol A

This solvent having a specific gravity at 60/60°F of 0.873, a distillation range of 160 - 182°C, an aromatics content %vol, of 98.5 and a Flash point abel °C of 43 has been found to be most acceptable. This material is available at 55 G. cents/lb from Shell Antilles and Guyanas Ltd. High Street, Georgetown.

3.33 Acetone

This solvent should comply with the following specification: A purity of 99.5% min, a water content of 0.3% max a relative density at 20/20°C of 0.791 - 0.793, a distillation range at 760 mm Hg IBP°C 55.8 min DP°C 56.6 max, Acidity (other than carbon dioxide) as acetic acid %wt 0.002 max, Non-volatile matter g/100 ml 0.001 max.
This solvent is available at 73 G cents/lb from Shell.

Antilles and Guyanas Ltd, High Street, Georgetown.

3.34 Hexylene Glycol

This solvent is available at 1.26 G. cents/lb from Shell Antilles and Guyanas Ltd, High Street, Georgetown.

3.4 Emulsifiers

Experience has shown that emulsifiable concentrates complying with FAO specifications can be manufactured using the above specified solvents together with emulsifiers available from either Messrs Tensia Liege Belgium or Messrs Hoechst Germany.

Both these firms will be pleased to provide recipes for individual pesticide emulsifiable concentrate incorporating their emulsifiers together with prices of the emulsifiers. When writing to the firm please state the solvent it is intended to use as well as the pesticide and its concentration in the final formulation.

3.5 Wetting and Suspending Agents:

Suitable wetting and suspending agents for use in the formulation of Wettable Powder Products are as follows:

3.51 Wetting agents

Empicol LZ a commercial grade of sodium lauryl sulphate is available from Marchant Products, Whitehaven England. A similar product is also available from Messrs Tensia, Liege Belgium.

3.52 Suspending Agent

Tamol 731 manufactured by Messrs Rohm & Haas, USA and Vanisperse CB manufactured by Lignin Chemicals, Aktiesel-skapet Borregaard, Chemical Division, N - 1701 Sarpsborg, Norway have been found suitable suspending agents.

4. Preliminary lay-out of the plant, together with a description of the formulation process and a list of the major items of equipment

A typical lay-out for the proposed formulation plant complex is shown in Annex 3 Figure 1. This design will suit any of the alternative sites mentioned in a later section of the Report.

In order that a wide range of pesticides can be formulated economically, on a commercial scale, both now and in the future, the multi-purpose plant and associated storage shed (shown in the centre of the layout) is an essential part of the proposed pesticides complex. The details of the lay-out of this area shown in Annex 3 Figure 2 are described later. Associated with the plant is a decontamination area. The purpose of this area is to assist in the safe handling of pesticides by workers and this feature will be expanded below. Most of the other facilities shown on the complex are self explanatory apart from the waste treatment area. In this area, it is proposed to install an incinerator to destroy waste products without creating dumping or polluting problems.

4.1 Design Principles

To safeguard personnel from hazards involved during the manufacturing operations and to ensure that little or no contamination of the environment occurs, it is recommended that attention is given to the following proposals.

4.11 Plant design and operating procedures must provide

for sufficient cleaning possibilities to prevent cross-contamination of the products occurring.

4.12 Floor surfaces should be smooth and impervious to to avoid build-up of toxic materials.

4.13 Sharp edges and dead corners should be avoided as toxic materials may accumulate at those places.

4.14 Properly located access doors and long-hosed vacuum cleaners will facilitate cleaning of solid formulation plants.

4.15 Pipes in liquid formulation plants should slope towards the end of the line.

4.16 Gravity flow of materials is usually preferred.

4.17 A slight under pressure should be maintained in the equipment and ducts to prevent toxic vapours/dust escaping into the atmosphere.

4.18 The materials of construction selected for the equipment should be corrosive resistant, particularly valves and moving parts.

4.19 Electrical equipment such as motors, switches, lights and wiring within the processing area should conform with the requirements of the area classification as defined by the Institute of Petroleum 'Model Code of Safe Practice, Electrical, Part 1, 1965, in plants handling inflammable substances, usually "division 11" requirements prevail.

4.20 All equipment should be properly earthed. Plastic piping should be painted with a metal containing paint i.e. aluminium to prevent build-up of static charges.

4.21 Installation of emergency showers, eyebaths and washing basins in the working area are recommended.

4.22 Good general ventilation is essential to ensure satisfactory working conditions (comfort ventilation). The number of air changes per hour may vary between 6 and 10 times. In tropical climates, the air temperature will have to be controlled to keep the working conditions acceptable.

4.23 Local ventilation is needed at spots where toxic vapours or dusts may escape. The system therefore consists of a number of hoods and similar air extraction devices, connected to a central air extraction system.

4.24 Depending on the subject pesticide and the environment of the plant, it may be necessary to remove contaminants from the ventilation or process air before it is released into the atmosphere. The type of equipment required depends on whether vapour or particulate matter has to be removed.

4.25 In systems handling fine inflammable particles in air dust explosives can occur.

When handling/milling such products eg. carbaryl WP, full knowledge of the subject and adherence to principles generally recognised as required for such processes is essential.

The following methods to avoid an explosion inside the process equipment and to reduce the hazards for staff and property outside the equipment, are known.

(a) Suppression

(b) Inert blanketing

(c) Containment.

Suppression:- the explosion pressure is restricted within allowable limits by spraying suppressant material into the equipment. A supplier of these systems is Graviner (Colnbrook) Ltd., Poyle Mill Works, Colnbrook, Slough, Bucks, ENGLAND.

Inert blanketing:- by replacing the larger part of the oxygen in the air in an enclosed volume by an inert gas also provides safety.

Pressure containment:- This type of design will lead to somewhat higher initial capital requirements.

4.2.6 Spillages

The plant design and clean-up routine should be aimed at reducing the effect of any spillage to the minimum. A distinction should be made between liquid and solid spillages. Liquid spillages will mostly occur at liquid pesticides discharge points and around the filling apparatus. Leaking valves, pumps etc. should be repaired immediately and are therefore not supposed to form a constant risk of spillage. The floor should slope gently 1:100 towards a drainage point which is connected with an interceptor pit. The toxic drainage system of the plant must be kept separate from any rain water or other general drainage system in order to avoid overloading of the interceptor pit. The treatment of the spillage depends on the nature of the spilled product.

Solid spillages should be removed by means of a vacuum cleaner.

4.2 Description of the Formulation Process

It is envisaged that the Formulation Plant Unit will be housed in a two storey building with floors positioned to accommodate the necessary formulating equipment. The building will be contiguous with a single storey packaging and storage shed thus eliminating intermediate storage and enabling an integrated production and packing operation. A service lift and conveyor system will operate between the two floors of the main building for the movement of materials.

The building will basically be split into five areas and provide facilities for the manufacture of the following products: (see Annex 3 fig. 2).

(i) Liquid formulation;

(ii) Insecticide and fungicide dust concentrate, wettable powders and dusts;

(iii) Herbicide dust concentrate, wettable powders and dusts;

(iv) Granular products, pellets and ant baits;

(v) Suspension concentrates.

A description of the formulation process involved is given below:

(i) Liquid Blending Area (Flameproof)

This area will provide equipment for producing emulsifiable concentrates, ultra-low volume formulations and any oil formulations which may be required.

The equipment will mainly comprise stainless steel vessels, with agitators, meters, pumps and filters, piping and filling devices.

A steam heated vessel of 80 gallons (or other suitable) capacity is recommended. Solid and semi-solid material to be dissolved are weighed into the mixing vessel using the dormant platform scales situated in the same room. The solvent (e.g. xylene) contained in a suitably sized drum (e.g 40 gallons) is placed on the scales and by means of a pneumatic pump sufficient weight of solvent is transferred to the mixing vessel using plastic pipe to satisfy the recipe. During the entire operation the mixing vessel must be heated.

The mixing equipment is capable of heating and agitating the solvent so as to dissolve the necessary ingredients at the temperature stated in the recipe. When the solution is complete, it can be pumped, via a Cuno micro - Wynd ll Filter Cartridge contained in an AMF Type CT Cartridge Filter, where it is clarified to the drum receiver prior to despatch or further packing as necessary.

It should be noted that all electrical switchgear, lights, motors etc. are recommended to be flameproof to Buxton Type ll gasses.

(ii) Insecticide and Fungicide Powder Area

In this area various ingredients that have been weighed and proportioned by hand are tipped into a horisontal ribbon mixer mounted at a convenient height for this to be done on the upper floor. After being homogeniously blended and mixed the contents of the mixer are discharged into a suitable receptable.

The mixed ingredients are then fed into the hopper of a Sturtevant swing hammer screenless mill having an output of 500 lb per hour. Providing a satisfactory recipe is employed and the correct milling procedures are followed, the products emerging from this mill can be expected to comply with FAO specifications for dust concentrates. This dust concentrate may then be diluted with suitable carriers to yield field strength dusts (see below).

To prepare wettable powders, the recommended procedure is to blend and mill the formulation in the manner outlined above and then to feed this hammer milled product via a Vibra Screw Feeder to a Fluid Energy Mill, the air-borne material from this being collected in a Reverse Air Dust Collector.

Field strength dusts may be prepared by diluting dusts concentrates with suitable carriers. They may also be prepared in suitable cases (e.g. where toxic hazards do not arise) by impregnation of a carrier with a liquid toxicant solution.

The various ingredients which have been proportioned and weighed by hand are tipped into the horisontal ribbon mixer located on the upper storey. After being homogenously blended and mixed, the contents of the mixer are discharged by gravity into one of two holding bins via a suitable mixer two way discharge chute which is controlled by a value, the chute passing through a suitable hole performed in the floor and then into the area below where the holding bins are housed. One of the mixed material receiving hoppers is fitted at the outlet end with a valve bag packer together with other packing and filling devices, while the second receiving hopper terminates in a valve, e.g. a mucon valve.

Each of these two mixed material receivin hoppers has a special purpose; the former, terminating in a valve bag packer, is that of a holding bin for field strength dusts prior to packing, the latter, terminating in a mucon valve, is to hold the quantities of blended and mixed ingredients prior to milling in the manner already described for the manufacture of dust concentrates and wettable powders.

After milling the dust concentrate and wettable powders are collected in total dust collectors situated on the upper storey. The products are then ducted under gravity into holding bins which are located above the packing, filling and weighing machinery which is located on the ground floor.

Low and high pressure air, low pressure steam, cold water, drain, single and three phase electricity services and safety shower will be required in this area.

(iii) Herbicide Powder Area: To avoid risk of contaminating insecticides or fungicides with herbicides, it is recommended that a separate herbicide powder area be provided containing similar equipment to the insecticide and fungicide area.

(iv) Granular products, pellets and ant baits

It is intended that this area should be used for the manufacture of pesticide granules, pellets and ant baits.

As granular attapulgite (or similar material) is not available locally in Guyana it would seem that the spray/impregnation must be discounted as a possible process. Therefore, alternative processes which will involve considerable more know-how than spray impregnation must be considered. These are:

(i) "the stick on process" in which the active ingredient is caused to adhere to a central core of sand or similar material and the mass built up to the mesh size by the use of suitable carriers such as talc or kaolin which are known to be present locally.

(ii) "the agglomeration process" this involves the blending of a suitable dust carrier with a powdered or liquid pesticide followed by addition of water to the point where the powdered material can be readily granulated and finally dried.

The choice of the granulation method will be strongly influenced by the choice of pesticide. Consequently the technical know-how supplied by the manufacturer of that pesticide will be final in deciding what process should be used.

Pelleted rodenticides are manufactured in stages. Firstly, the grain is dried to the required moisture content (maize 16% moisture, rice 14% moisture) and then ground by means of a Christy Norris 17" Hammer Mill using 1/64" screen. The crushed grain is then blended with endrin 2% dust (or other pesticides) and the product pelleted by means of a Lister Farm Feed Pelleting Press (10HP) fitted with 7/16" diameter die ring. The knife is adjusted to give pellets of ½" - 1" in length. Finally, the pellets are packaged in six ply paper sacks with inner wax paper coating.

Meat baits are manufactured using similar but separate pelleting equipment. This is considered necessary to avoid rejection of the bait as a result of cross contamination with rodenticides. In this process, the ingredients are ground as required in a Christy Norris Hammer Mill. They are then blended together and pelleted.

V Suspension Concentrates

Suspension concentrate formulation, sometimes known as flowable dispersions are manufactured by the wet grinding of toxicant, structure agent and suspending agent. Normally the product ingredionts are milled in an attritor followed by perl milling.

No details of the manufacturing process for SC's have yet been published. It is anticipated that the manufacturer of the pesticide concerned will provide technical information as to the details of the type of equipment to be used, the manufacturing process to be adopted and test methods to be applied.

4.3 List of Major items of equipment

i) - Liquid Formulation Area

a) Steam heated vessel

b) Silverson Multi-Purpose mixer - emulsifier

c) Hydraulic floor stand for (b)

d) Dormant Platform Scale

ii) Insecticide and Fungicide Powder Area

a) Horisontal Ribbon Mixer

b) Startevant or Similar Swing Hammer Screenless Mill

c) Micronisor or Jetomiser fluid energy mill

d) Total dust collector for dust concentrate

e) Total dust collector for air milled wettable powder

g) 'Balanced' air vented weighing and packaging equipment

g) Explosion protection equipment

iii) Herbicide Powder Area

As for ii

iv) Granular prodcts, pellets and ant bait area

2 - Christy Norris Hammer Mills

2 - Lester Farm Food Pelleting Machines

1 - Granulation equipment as selected

v) Suspension Concentrates

2 - Attritors

1 - Perl Mill

vi) General Services

1 - Broomwade Air Compressor to supply air to run air jet mill complete with after cooler and motor.

1 - Central air extraction system complete with dust collector.

4.4. Solid and Liquid Waste Disposal

The best way of detoxifying solid waste is incineration at high temperature. A specially designed openpit incinerator is suitable for this purpose.

Liquid waste may arise from spillage which should where ever possible be absorbed into sawdust or similar

material and incenerator.

Large amounts of liquid spillages which cannot be absorbed, are allowed to flow into the toxic drainage system, but in order to prevent downstream troubles (in effluent treatment) an interceptor is recommended to catch the oil.

Treatment of the interceptor outflow is done by the usual well known methods.

Analysis of the treated effluent at suitable intervals is essential to ensure that the treatments carried out have been efficient.

4.5 Decontamination Area

All plant operatives have to be provided with a complete change of clothing together with appropriate personal protective equipment. In order to prevent cross- contamination of clothing, all workers should be provided with a locker outside the area for their own clothing, and a locker in the working area for their work clothing and protective equipment.

Lockers for their own and working clothing should be separated by shower facilities. After work the worker should take a shower before dressing in his private clothing. As eating, drinking and smoking is not permitted in the working area, facilities outside this area should be provided for coffee and luncheon breaks.

To minimise contamination it is recommended that personal protective equipment e.g. overalls, helmet, gloves and boots are left on the plant and the operator washes hands, arms and face before putting on a house-coat and slippers to walk to the canteen.

5 Site Selection for the Formulation Plant

In the Experts first report[3], it was stated that there were at least two acceptable locations for the plant, (1) Georgetown because it was the centre of commercial activity and not too far removed from the Kaolin deposits at Ituni and (2) the agricultural areas (200 - 300 miles from Georgetown. Further attention has now been given to the subject and it appears an additional advantage if the selected site allows easy access for both sea vessels and road transport; thus ensuring that transport costs of incoming and outgoing materials are kept to a minimum.

In separate discussions with Mr. Phang (Superintendent of Lands) and Mr. H.A.D. Chesney, both suggested the possibility of a site in the 'Farm' area on the east bank of the Demerara River between Georgetown and Timehri. Through the good offices of Mr. Maurice King, Acting Permanent Secretary to the Minister of Agriculture arrangements were made for me to visit the area and inspect the various sites.

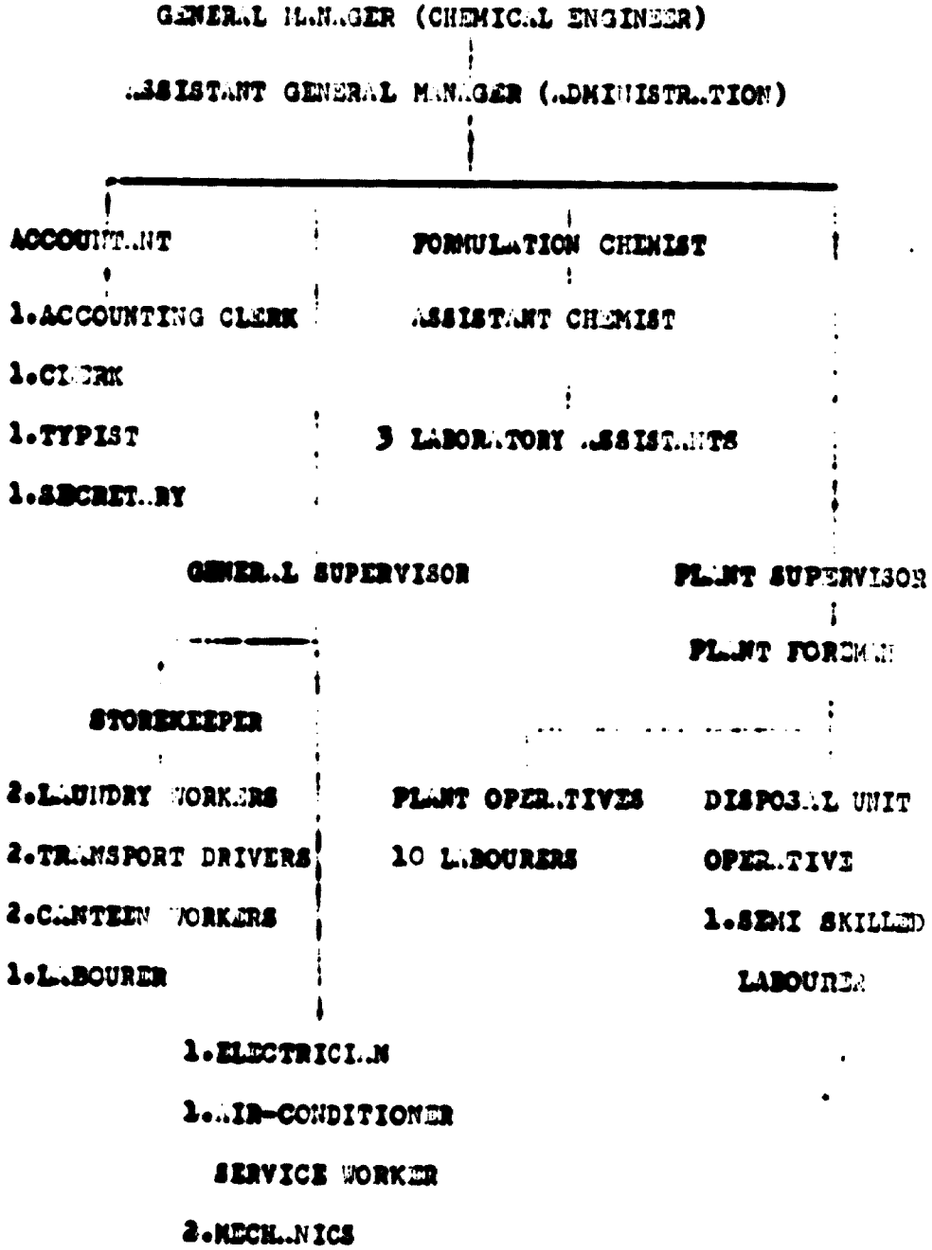
Five sites were selected as being worthy of further consideration. These are shown in Annex 3 Figure 3 and 4. Of these those shown in Figure 3 are of special interest as the sites are potentially approachable from both the road and the sea. However, in case the soil did not prove suitable to carry foundations for the type of building, it was decided to include site 4, see Figure 4.

Of all these sites, the most favourable would

appear to be site 5 Figure 3, because it has the advantages listed above and also already has a simple 2,4-D plant belonging to the Demerara Sugar Company built on it. In brief the proposal would be to drive a road with suitable bridges to the river and there construct a wharf providing there is sufficient water for the loading and unloading of appropriately sized vessels. The plant complex could then be built on suitable land between the present Georgetown/Timehri road and the river. It is understood that the land already belongs to the Government of Guyana.

6 Draft Organisation Chart

The following draft organisation chart is proposed for the pesticide formulation complex.



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7 Follow-up Technical Assistance by UNDP/UNIDO

Follow-up technical assistance by UNDP/UNIDO is needed in several areas. Assuming the decision to go ahead with the plant is confirmed, technical assistance will be required with respect to tender specifications, contracting, the erecting and start-up of the plant.

In this connection, the expert understands from Mr. J.F. Vine, General Manager, Materials Processing and Handling Department, Startevant Engineering Co. Ltd., Hamlyn House, Highgate Hill, London N 19 5PP, that his company is prepared to tender for the work. The expert has first hand experience of the sound knowledge of Mr. Vine and of the considerable 'know-how' acquired by the Startevant Co.

A second area in which technical assistance will be required is in placing personnel needing specialised training overseas. Here UNIDO can give assistance by making arrangements on behalf of the Government of Guyana with suitable organisations which are prepared to offer such training.

A third area in which technical assistance will be required is in providing the Government of Guyana with a more detailed assessment of the export market than it has been possible to provide in the present report.

8 INVESTMENT FOLLOW-UP

8.1 Market Potential

8.11 Volume and Value of Annual Local Demand

The volume and value of the annual demand in Guyana for the products to be manufactured by the project at present, for the last five years and the next five years (projections) are given in Annex 2 Tables 1 and 2.

The volume and value of the annual demand for the other territories of the CARICOM are given in Annex 2 Tables 3,4,5,6 and 7.

8.12 Description of the Market

2,4-D amine salt is the only pesticide manufactured in Guyana. All the others are imported as the formulated products by the International Agrochemical company's or their Agents. Those pesticide formulations are sold by local pesticide suppliers to the Government, Messrs. Bookers Sugar Estates Ltd., The Rice Marketing Board and to Growers.

The major local suppliers are:

a) Shell Antilles and Guianas Ltd.

b) Chemagon Industries Ltd.

c) Bel Park Agencies.

d) Geddes Grant T (Guyana)Ltd.

8.13 Future Potential Competitor of the Project

Mr. J.A. Pires of Caribbean Chemicals & Agencies Ltd., Trinidad has submitted a proposal to the

Trinidad Government which would enable him to set up a formulation plant in Trinidad. He says he will not undertake the investment in this plant unless he is given protection (by licence) by the Government against the importation of manufactured formulations. Mr. Pires hopes to receive the decision of the Trinidad Government concerning his application in the near future.

8.14 Description of existing and projected tariff situation

Tariff and other forms of protection

For the purpose of Customs Duties, countries of origin are categorised under the following heads in order to effect differential duty rates.

a) Preferential - Imports originating from British Commonwealth sources.

b) General - Imports originating from non-Commonwealth sources.

Forms of Protection

a) Tariff Manipulation - In which case the rates both preferential and general are increased.

b) Non-payment of duty - In which case the duty on imported inputs is waived, while maintaining the existing or alternatively increasing the duty rate on imported products that are locally produced.

c) Ban - The imposition of a ban on similar imported goods, which are locally produced may be considered. This form of incentive

is recommended only after careful investigation is made into quality, price, the ability to satisfy the local requirements and the effect such measures would have on the local economy.

d) Quantitative Restriction - In an attempt to enable local manufacturing enterprises to exploit existing market potential, imports which compete with the locally produced commodity could be restricted to a percentage of the country's requirements using a suitable base year.

Export Allowances

To assist in encouraging exports an enterprise may be granted partial relief from the Income Tax chargeable on the profits earned, from exports. This provision, becomes operative obviously after an enterprise's Tax Holiday has expired. This concession may be granted for an unlimited period.

This incentive provides for greater relief, the greater the share of an enterprise's profits, which is derived from its exports, as against its Caricom and domestic sales.

The following table gives the extent of maximum relief in terms of credit on tax chargeable on the share of profits made from export sales.

Percentage share of Export Profits in Total Profits	Maximum tax relief of the Tax Chargeable
10% but less than 21%	25%
21% " " " 41%	35%
41% " " " 61%	45%
61% or more	50%

8.15 Projects Marketing and distribution policy

In 1974 the Ministry of Agriculture formed a Plant Protection Division. Among the responsibilities of this new division was the establishment of a number of distribution centres which had the duty of supplying pesticides for the protection of crops other than rice and sugar.

It is believed that the production from the pesticide formulation plant can be arranged to provide a reliable supply for the Government's new distribution centres as well as providing inputs to the rice and sugar industry. However, details of the arrangements have still to be worked out.

With respect to the export market, a special study is required both to quantify the market in more detail than has proved possible in this report and especially to work out a suitable marketing policy to ensure that each CARICOM member received adequate and reliable supplies on request.

8.2 Management and Labour Requirements

8.21 Prospective Owners

A decision on this subject cannot be expected until the Minister of Agriculture and in due time the Cabinet have examined the proposals contained in this report.

8.22 Management of the Plant

A draft organisation chart is included under section 6. The experts views on training programme for key personnel is recorded in section 7.

8.23 Labour availability, skills and costs

Like most developing countries Guyana has a relatively high degree of unemployment. However from a high level of literacy (80% approximately) it should not be difficult to transform them into skilled workers. It would however be necessary to secure initially from abroad, some of the technical requirements for certain new industries.

Wage rates in Guyana are modest in comparison to other parts of the world. The table below gives an example of prevailing rates for some categories of government employees.

OCCUPATION	PERIOD	BASIC/SALARY RANGE
Labourer 1 (light duty)	Per hour	68¢ - 78¢
Labourer 11(heavy duty)	" "	74¢ - 90¢
Welder 1	" "	79¢ - 90¢
Welder 11	" "	84¢ - 95¢
Welder 111	" "	97¢ -1.12¢
Electrician 1	" "	82¢ - 92¢
Electrician 11	" "	97¢ -1.12¢
Computer 1	" "	79¢ - 90¢
Computer 11	" "	84¢ - 95¢
Computer 111	" "	88¢ -1.01¢
Typist 1	per month	160.00 -226.00 GJ
Typist 11	"	176.00 -281.00
Clerk 1	"	160.00 -226.00
Clerk 11	"	184.00 -310.00

8.24 Caribbean Development Bank Assistance

The interest shown by the Bank is recorded in section 1.61.

8.3 Raw materials and utilities

The source of supplies and costs are shown in Section 3.

8.4 Government Policies

8.41 Privileges, exemptions and any other advantages to be enjoyed by the project

The fiscal incentives offered to industries in Guyana, are based on the Harmonization Agreement of the Caribbean Community Treaty. These incentives are intended to stimulate local investment and attract foreign investors. For an enterprise to enjoy the benefits, it must be incorporated in Guyana. The

extent of benefits to be enjoyed by an enterprise is related to the contribution which the enterprise makes to the national economy. The contribution of the enterprise is measured, broadly, in terms of the local value added, but in addition other specific criteria will be considered before the extent of the benefits to be enjoyed is decided.

These may include the following:

(i) That the industry should lead to the development of the country's resources, including the absorption of local labour.

(ii) They should lead to technological development.

(iii) They should lead to savings in foreign exchange (import substitution), and if possible should earn foreign exchange.

(iv) The location of enterprise in new 'development' regions.

(a) <u>Tax Holidays and rebate on Customs Duty</u>

The main benefits which can be given to a company are exemption from Income Tax, and relief from Customs Duty over a stated number of years. The number of years for which benefits may be granted vary according to the value of the 'enterprises' contribution to the national economy. For the award of benefits, enterprises are classified into the following groups:

GROUP 1 Enterprises whose local value added in respect of the approved product(s) amount to 50% more of the value of sales of the product(s).

GROUP 11 Enterprises whose local value added in respect of the approved product(s) amount to 25% but less than 50% of the receipts from sales.

GROUP 111 Enterprises whose local value added in respect of the approved product(s) amount to 10% but less than 25% of the receipts from sales.

In addition there is a group of enterprises whose entire production of the approved product is sold to countries outside Caricom. This group referred to as Enclave Industries is eligible for Tax Holidays, etc, without reference to the quantity of the local value added.

The following table shows the maximum number of years for which any enterprise may be granted relief from Income Tax, and Customs Duties.

Group	Maximum number of Years Relief
1	9
11	7
111	5
Enclave	10

In addition to the classification appearing in the table above, any industry that is highly capital intensive in nature, i.e. with a capital investment not less than $50 million may be granted the foregoing benefits for a period not exceeding 10 years.

(b) Dividends to be Tax Exempt

Dividends paid from profits of approved products that have been granted a Tax Holiday should also be exempt from tax, so long as the share holder is resident in a Caricom country.

Where, however, the shareholder is not resident in a Caricom country, dividends will not be totally exempt from tax, but only from that amount of tax that is in excess of what he would normally have paid on such dividends in the country where he resides.

(c) Carry Forward Losses

An enterprise granted a Tax Holiday can carry forward any net loss it makes during the total holiday period setting them off against profits. This concession is granted for a period of up to five years after the expiry of the Tax Holiday.

(d) Initial Allowance

In addition to the depreciation allowance to which enterprises are normally entitled, an approved enterprise on expiry of its Tax Holiday may be granted an initial allowance not exceeding 20% of any capital expenditure incurred on plant, equipment and machinery, after the Tax Holiday period has expired.

It must be stated that the granting of any of the above fiscal incentives in the final analysis rests with the recommendations made by the Small Industries Corporation to the Minister of Finance, who is the relevant authority designated to administer these concessions.

Other Forms of Incentive Benefits Applicable to Industrial Investments

Taxes Including Municipal Taxes

(a) As already indicated the Income Tax Holiday period could at the discretion of the Competent Authority range from one to ten years. However, there is no exemption from Municipal Taxes once the enterprise is located within a Municipal area.

(b) Consumption Tax.

Some commodities manufactured locally on the basis of duty free materials are subjected to the payment of a Consumption Tax collectable at source. Similar imported commodities are therefore subjected to the Consumption Tax at the same level in order to avoid discriminatory treatment, and hence unfair competition. Commodities exported are not subjected to the Consumption Tax.

(c) Property Tax

A Property Tax is levied on the net property of all Companies and individuals in Guyana. Notwithstanding this however, any Company granted an exemption from Income Tax on or after January 1st, 1965, by a Tax Holiday under section 11 of the Income Tax (In aid of Industry) Act,

Chapter 81:02 in respect of its property employed in the business of the Company on the Income of which, such exemption from Tax is granted during the Tax Holiday period is exempted from the payment of such a tax.

(d) Guaranteed rights for Repatriation of Capital

There is no restriction against the repatriation of capital of an approved enterprise. However, unless exempted, a withholding tax deductable at source is imposed on dividends.

(e) Double Taxation Agreement

There is no double taxation agreement, which is in operation. Unilateral relief can, however, be applied.

(f) Bilateral Investment Guarantee Treaties

Guyana at this moment has not made any Bilateral Investment Guarantee Treaty with any country. However, for all investments of the United States of America, in Guyana, the United States Agency for International Development operates an Investment Guarantee Scheme.

C - RECOMMENDATIONS

It is recommended that:

1. A multi-purpose pesticide formulation complex be built in Guyana.

2. The formulation complex should be located at Farm, East Bank Demerara, and should include the Government's 2,4-D amine formulation plant already located there.

3. The complex should include a multi-purpose formulation plant and other necessary services such as a decontamination area and a waste treatment area.

4. The formulation plant should be centrally located on the site and should consist of a two storey building to permit the gravity flow of various products. Contiguous with this building is a single storey packaging and storage area.

5. Messrs. Startevant Engineering Co. Ltd. Hamlyn House, Highgate Hill, London N 19 5PP should be approached to provide tender specifications for the erection of the formulation complex.

6. Messrs. Shell International Chemical Co. Ltd. (Agrochemical Division) Shell Centre, London should be approached to see whether they are willing to give specialised training to the Formulation Chemist Designate. (See Experts previous Report [illegible] for details of training required).

7. Messrs. SICM, (CAMF Division) The Hague Netherlands, be approached to see whether they are willing to give specialised training to the Plant Supervisor Designate.

(See Expert's previous Report [1] [2] for details of training required).

8. If financial aid is required, an approach could be made to the Caribbean Development Bank, Barbados. (See Section 1.61).

9. An expert should visit the plant when production commences to ensure that the equipment is functioning properly and that the product produced is on specification.

10. Milling trials should be carried out with the Kaolin from Topira as soon as test quantities become available from the Surveys and Mines Department, Georgetown.

ANNEX 1 D. APPENDICES

PERSONS AND INSTITUTIONS CONTACTED

1. United Nations Industrial Development Organisation, Vienna

1.1	R. Aguilar - Bolanos	Programme Management Officer for the Caribbean, Section for the Americas, Technical Co-operation Division.
1.2	Habib Khoudja	Programme Co-operation Section of Technical Co-operation Division.
1.3	M.C. Verghese	Head, Fertilisers, Posticides and Petroleum Industries Section. Industrial Technology Division.
1.4	K. Szabo	Industrial Development Officer. Fertilisers, Pesticides and Petroleum Industries Section.

2. United Nations Development Programme, Georgetown.

2.1	Alexander Simon	Resident Representative a.i.
2.2	Miss B. Nygren	Assistant to the Field Advisor.

3. United Nations Development Programme, Port-of-Spain

3.1	Ross H. Milloy	Assistant Resident Representative
3.2	William E. Elwell	Petroleum Consultant, UNIDO.

4. United Nations Development Programme, Kingston

4.1	Hollis Murray	Senior Agricultural Advisor/ FAO Country Representative.

5. Ministry of Agriculture, Georgetown

5.1	Gavin Kennard	Minister.
5.2	Maurice King	Acting Permanent Secretary.
5.3	H.A.D. Chesney	Acting Chief Agricultural Officer.
5.4	Dr. A.V. Downer	Deputy Chief Agricultural Officer.
5.5	M.S. Rahim	Principal Assistant Secretary.
5.6	M. Phang	Superintendent of Lands Division
5.7	Chang Yen	Senior Surveyor, Survey Division.

6. Ministry of Agriculture, Science & Technology, Bridgetown Barbados

6.1	Oswald Parris	Economist.
6.2	Hillary Clarke	Economist.
6.3	Dr. E. Alleyne	Entomologist
6.4	Merland Burke	Research Officer

7. Ministry of Agriculture, Castries, St. Lucia

7.1	Cecil Wooding	Permanent Secretary.

8. Ministry of Agriculture, Lands & Fisheries, St. John's Antigua

8.1	John Hardie	Regional Economic Agricultural Adviser.

9. Ministry of Agriculture, Kingston, Jamaica

9.1	A.G. Naylor	Director of Crops and Soils.
9.2	Van Whorvin	Chief Plant Protection Officer.
9.3	George Corrie	Secretary of Drugs and Poisons Control Board.

10.	Ministry of Economic Development, Georgetown	
10.1	Winston King	Economic Adviser.
10.2	A.R.K. Khan	Principal Assistant Secretary (Foreign Aid).
11.	Ministry of Energy & Natural Resources, Georgetown	
11.1	Hubert Jack	Minister.
11.2	Hopkinson	Commissioner.
11.3	Fritz Weihrauch	Geologist.
12.	Ministry of Trade, Industry & Commerce, Barbados	
12.1	Carl Hinckman	Assistant Secretary.
12.2	Nevill S. Brown	Economist.
13.	Central Agricultural Research Station, Mon Repos, Guyana.	
13.1	Dr. R. Fletcher	
13.2	Dr. J.G. Muller	Head of Plant Protection Division.
13.3	Dr. B.K. Rai	Entomologist.
13.4	Dr. K. Croal	Head of Plant Quarantine Division
14.	Central Experimental Station, Centeno, Trinidad	
14.1	Winans Bishop	Technical Officer, Crop Research.
14.2	Dr. R.N. Barrow	Entomologist.
14.3	Gordon A. Laurance	Entomologist.
15.	British Development Division in the Caribbean, St. John's Antigua.	
15.1	N.S. Irving	Regional Entomologist Advisor.

16. Windward Islands Banana Growers Association (Roseau) WINBAN, St. Lucia

16.1 Dr. Joseph Edmunds — Director of Research & Development.

16.2 S. Gowan — Nematologist.

16.3 Graham Mitchell — Entomologist.

17. Commonwealth Caribbean Pesticides Control Unit Chemistry Department, University of the West Indies, Trinidad.

17.1 Dr. R.D. Gibbs — Director.

18. Caribbean Community Secretariat, Georgetown

18.1 David Fletcher — Economist.

18.2 Fitzroy Fletcher — Engineer.

19. East Caribbean Common Market Secretariat, St. John's Antigua

19.1 George Williams — Executive Secretary.

19.2 Gulston — Agricultural Economist.

20. Small Industries Corporation, Georgetown.

20.1 Dudley Chase — Deputy Manager.

20.2 Neil Fraser

20.3 Noel A. King — Industrial Engineer.

21. Guyana Marketing Corporation, Georgetown

21.1 Hugh Saul — General Manager.

22. Guyana Rice Board, Georgetown.

22.1 C.P. Kennard — Deputy Director Research.

23. Bookers Sugar Estates, Georgetown

23.1 Trefor Ellis — Chairman.

23.2 John Bates — Senior Agricultural Officer.

24. Caroni Ltd., Couva, Trinidad

24.1 Tommy Carr — Research Director.

25. The Barbados Sugar Producers Association, Barbados

25.1 D.H.A. Johnson — Executive Officer.

26. Sugar Industry Research Institute, Mandeville, Jamaica

26.1 M.E.A. Shaw — Director of Research.

27. St. Lucia Banana Growers Association, Castries

27.1 Simon Gage — General Manager.

28. All Island Banana Growers Association - Kingston

28.1 Walker — Manager(Banana Board).

29. Coffee Industry Board, Kingston

29.1 F.A. Briscoe — Manager.

29.2 A. Moss — Technical Assistant.

30. Caribbean Development Bank, Wildey, Barbados

30.1 Lewis G. Campbell — Head of Agriculture Division.

31. Trinidad & Tobago Oil Company (TRINTOC)-Port-of-Spain

31.1 Eric de Vertouil — Automobile Retail Manager.

31.2 Dean Saidwan — Marketing Agronomist.

32. Shell Antilles and Guianas Ltd. Georgetown.

32.1 E. Fredericks — Manager.

33. Shell Chemicals and Services (East Caribbean) Ltd., Trinidad.

33.1 J.K.B. Burke — Chemicals Manager.

33.2 Victor Hoo-a-Shu — Entomologist.

34. Ciba Geigy Representative, Georgetown

34.1 Fordie Schneidersmann — Technical representative.

35. Technical Sales Representatives, Barbados.

35.1 John Gittens — Dowding Estates & Trading Co. - Ciba Geigy.

35.2 Robert Massiah — Carter & Co. - May & Baker, Schering.

35.3 Anthony Bryan — Plantation Trading - Shell, Amchem, Roehat Pisons.

35.4 Charles Bradshaw — Geddes Grant - Dow, Plant Protection.

35.5 Richard Carter — Carter & Co. - Union Carbide, Rohm & Haas - May & Baker Schering.

35.6 John Mascll } — Da Costa & Musson - Dupont, BASF.

35.7 Dennis March }

36. Caribbean Chemicals and Services Ltd.

36.1 John Carrington — Manager.

36.2 Alvin A. Thompson — Assistant Manager.

ANNEX 2

TABLE 1 Volume and Value of Annual demand for Pesticide on Rice in Guyana (Source: 1969 Ann Rep, Min Agric. 1971 to 1975 Incl. Chas Kenmare, Guyana Rice Board)

YEAR	1969		1971		1972		1973		1974		1975	
PESTICIDE	VOLUME	VALUE G$	VOLUME	VALUE G$	VOLUME	VALUE G$	VOLUME	VALUE G$	VOLUME	VALUE G$	VOLUME	VALUE G$
2,4-D amine salt (6 lbs/gln)			840.25 gln	7,142.13	1,128 gln	6,768.00	1075 gln	13,942	2630 gln	41,080	5795 gln	140367
Propanil 30% EC			408 gln	8,210.00	400 gln	5,656.00	900 gln	13,365	376 gln	5634	5487 gln	138016
Trichlorphon 80% WP	3468 lbs		3084 lbs	13080.60	4,400 lbs	9,630.00	9,000 lbs	1[illegible],000	12,000 lbs	30,[illegible]99	11000 lbs	45750
Fenitrothion 50% EC	4 gln		634 gln	11167.20	1,000 gln	19,800.00	2,000 gln	37,190	2,405 gln	45260	8270 gln	334367
Monocrotophos 60% WSC			778.5 gln	18061.20	770 gln	32,324.00	1,025 gln	39,402	2,275 gln	118250	3000 gln	266500
Aldrin 40% WP			3357 lbs	4531.95	2,310 lbs	3,372.00	10,000 lbs	17,200	9,[illegible]0 lbs	17,525	11200 lbs	29750
Dieldrin 20% EC	37 gln		147.75 gln	1,950.30	200 gln	2,800.00	300 gln	5,340	1,6[illegible]3 gln	27,295	564 gln	11562
Lindane 25% WP	722 lbs		1094 lbs	3,030.40	4,090 lbs	8,180.00					-	-
Lindane 25% EC			-	-	600 gln	6,692.00	1500 gln		1,050 gln	20,795	-	-
BHC 10% dust	17784 lbs		43758 lbs	3,938.22							-	-
Carbaryl 5% dust	27695 lbs		14889 lbs	1,191.12							-	-
Carbaryl 85% WP	1652 lbs		8542 lbs	16229.80			30,000 lbs	59,700	40,000 lbs	80,[illegible]00	40,000 lbs	129600
Pirimiphos methyl EC			-	-	15 gln	1,200.00	20 gln	1,[illegible]6	145 gln	11,125	500 gln	52500
Phosphamidon 100% EC			-	-					483 gln	31,395	-	-
Carbofuran 75% WP			-	-							1000 lbs	3500
Niclosamide 70% WP	200 lbs		1030 lbs	5356.00			4,000 lbs	26,[illegible]00	4,504 lbs	54,300	4000 lbs	50300
Aposan GN			2306 lbs	1383.60			5,000 lbs	4,[illegible]00			-	-
Verdesan			1072 lbs	321.60							-	-
Edifenphos EC			26.5 gln	487.60	132 gln	4,983.00	200 gln	8000	200 gln	10,[illegible]	-	-
Benomyl 50% WP					600 lbs	5,100.00			5[illegible]00 lbs	93,5[illegible]0	4[illegible]3 lbs	96,[illegible]00
Kitazin 48% EC							100 gln	3,647	1,276 gln	39,9[illegible]3	6000 gln	219150
Fernasan 75%											5[illegible]00 lbs	13,200
Panogen											220 gln	7,640
Copper Sulphate	84 lbs										1[illegible]00 lbs	8,[illegible]00
PCP											10000 lbs	13,700
Total weight of solid formulations			82932 lbs		11460 lbs		58000 lbs		71584 lbs		87192 lbs	
Total volume of liquid formulations			2835 gln		4245 gln		7801 gln		12643 gln		29836 gln	
Total wt of solid & liquid formulations assuming density of liquids =1			111282 lbs		53910		136010 lbs		197934 lbs		385552 lbs	
Total Value G$	-			96,082		[illegible]		[illegible]487		637602		1562,102

TABLE 2

Volume and Value of Annual Demand for **Pesticides used on Sugarcane in Guyana**
(Source: J.F. Bates, Bookers Sugar Estates Ltd.)

Year	1969		1970		1971		1972		1973		1974	
Pesticide	Volume	Value G$	Volume	Value G$	Volume	Value G$	Volume	Value G$	Volume	Value G$	Volume	Value G$
2,4-D amine salt (6 lbs/gln)	29,345 gln	119454.15	33,480 gln	125550	30,783 gln	120669	36,233 gln	171020	27,708 gln	238315	50,000 gln	328000
2,4,5-T	-	-	90 gln	12.5	-	-	35 gln	4.9	45 gln	6.3	-	-
PCP 25% EC	26.125 gln	39.71	375 gln	990	495 gln	1307	295 gln	778	225 gln	594	135 gln	680
Endrin 2% Pellets	59318 lbs	11270.42	30013 lbs	6302.7	29625 lbs	5332	80924 lbs	14566	58275 lbs	12238	45,500 lbs	13650
Zinc phosphide 3% Pellets	1960 lbs	254.80	3080 lbs	462	280 lbs	39	1350 lbs	202.5	4800 lbs	720	1725 lbs	259
Thallium sulphate 2% Corn Bait	418 lbs	3080.66	352 lbs	2594.2	418 lbs	3047	552 lbs	4140	473 lbs	3699	638 lbs	5882
BHC 13% gamma Isomer	42168 lbs	9276.96	37152 lbs	8545	31556 lbs	7889	38758 lbs	10,077	18574 lbs	5386	62720 lbs	42650
Dalapon (tech) Sodium salt 85%	108,029 lbs	33182.33	139740 lbs	103,407	147340 lbs	103,138	162140 lbs	145926	76160 lbs	73113	67200 lbs	120960
Triazines 85% WP	-	-	-	-	4,901 lbs	22544.6	15,360 lbs	72956	45,859 lbs	217830	239,873 lbs	1199,365
Malathion 60% EC	1856.25 gln	13117.00	1358 gln	13472	766.5 gln	7604	1990 gln	19742	1891 gln	21175	1500 gln	24000
Trichlorphon (Dipterex) 80% WP	302.00 lbs	724.80	689 lbs	1654	422 lbs	1013	340 lbs	816	295 lbs	708	519 lbs	1246
Monocrotophos (Azodrin) 60% EC	-	-	-	-	-	-	79.625 gln	1911.0	83.5 gln	8678	54 gln	3715
Dimethoate 40% EC	-	-	-	-	-	-	-	-	80 gln	3377.6	94 gln	37440
Aldrin dieldrin endrin EC	182.25 gln	2305.46	230.625 gln	3284	730.625 gln	[illegible]	775.625 gln	11045	1277.5	18192	2500 gln	50,000
Asulam 40% EC	-	-	-	-	50[illegible] gln	10500	7,600 gln	136428	16,000 gln	429760	17,000 gln	585990
Ioxynil 40% EC	-	-	-	-	220 gln	2604.8	3200 gln	51200	7500 gln	137250	2200 gln	79244
Total weight of solid formulations	212195 lbs		211025 lbs		214542 lbs		299924 lbs		2[illegible]436 lbs		418175 lbs	
Total volume of liquid formulations	31410 gln		35303 gln		[illegible]		50208 gln		54810 gln		73483 gln	
Total wt. solid & liquid formulations lbs assuming density of liquids =1	526,295		564053 lbs		549492 lbs		802004 lbs		752556 lbs		1135003 lbs	
Total Value G$	-	247686		[illegible]		[illegible]		[illegible]		1171042		[illegible]

TABLE 3: HERBICIDE USAGE IN WEST INDIES SUGAR INDUSTRY - 1972

Common Name	Normal Formulation	Foliar/Soil application	Jamaica	Trinidad	Barbados	St. Kitts	Guyana	Estimated Annual Usage
2.4-D	6# a.i./gln. Amine	F/S	++	++	++	++	+++	80,000 glns.
2.4-D	4# a.i./glr. Ester	F/S	++		+			20,000 glns.
Actril D	4# a.i./glr. Salt	S	++	++	++		+	40,000 glns.
Gesaprim	80% W.P. T	S		+++	++	+	+	120 tons
Gesapex	80% W.P. T	S		++	++		++	50 tons
Asulox	40% Sodium Salt	F/S	+++	+++	+++	++	++	55,000 glns.
Telvar	80% W.P. SU	S		++	+		++	10 tons
Daconate (DSMA)	60% E.C.	F/S		++		++		8,000 glns.
2.4.5-T	4# a.i./gln. Ester	F/S	++		+			1,500 glns.
Dalapon	85% W.P.	S	+++	+++		+	+++	140 tons
Karmex	80% W.P. SU	S	+++	+++		+	+	40 tons
Gramoxone	2# a.i./gln. E.C.	S	+++	+++		+	+	10,000 glns.
T.C.A.	Sodium Salt	S	++			++	++	40 tons
Posco 18-15		F/S		++				4,000 glns.
P.M.A.	0.5% w/v.	S	+	+	+			1,000 lbs.
P.C.P.	15% E.C.	S					++	1,500 glns.

+++ = Extensive use
++ = Frequent use.
+ = Irregular use.

W.P. = Wettable Powder
E.C. = Emulsion Concentrate
T. = Triazine

SU = Substituted Urea
OM = Organo-mercurial

TABLE 4: PESTICIDE USAGE IN WEST INDIES SUGAR INDUSTRY - 1972

Common Name	Normal Formulation		Foliar/Soil application	Jamaica	Trinidad	Barbados	St. Kitts	Guyana	Estimated Annual Usage
Sevin	80% W.P.	C	F	+++				+	20 tons
Malathion	60% E.C.	OP	F	+++	+++			+++	35,000 gins.
Azodrin	50% E.C.	OP	F	+	++		+	+	1,400 gins.
Umden	5% granular	OP	F/S		+++				30 tons
Kilval	30% E.C.	OP	F		+++				12,000 gins.
Dimethoate	40% E.C.	OP	F		+			++	500 gins.
Agrocide (BHC)	0.5% Dust	CH	S		+			+++	15 tons (Tech.)
Anthio	40% E.C.	OP	F		+				500 gins.
Diazinon	10% granular	OP	F		++				2,500 gins.
Dipterex	80% W.P.	OP	F					+	800 lbs.
Endrin	20% E.C.	CH	F					++	1,000 gins.
Rodenticides									
Endrin	2%) in			+				+++	800 lbs. Tech.
Zinc Phosphide	2%) various		S	+				+++	500 lbs. Tech.
Thallium Sulphate	2%) cereal							+++	500 lbs. Tech.
Warfarin	0.025%) baits			++	++	++	+		

+++ = Extensive use
++ = Frequent use
+ = Irregular use

CH = Chlorinated Hydrocarbon
OP = Organo-phosphate
C = Carbamate

1970 Demand for

...pson, Caribbean

Pesticides on individual crops in Jamaica

Chemicals & Services (Jamaica) Ltd

	Actril K ioxynil + 2,4-D LV esters	Asulox 60 60% asulam 6 lb ai/ Imp gln	Gramoxone 2 lb paraquat /Imp gln	Daconate 475 lb MSMA/ US Gln	Hermex 80% diuron	Gesaprim 80% atrazine	Gesapax 50% ametryne	T.C...	Dowfume MC-2 98% Me Br +2 Chloropicrin
LV	US Glns	US Glns	US Glns	US Glns	lbs	lbs	lbs	lbs	lbs
		500	10,000	[illegible],000	12,000	22,500	4,000		
	-	-	5,000	500	8,000	500	-		
	-	-	3,000	500	27,500	1,500	-		
	-	-	3,000	250	4,000	500	-		
	-	-	300	-	200	-	-		
	-	-	100	-	-	-	-		
	-	-	500	200	-	-	-		
	-	-	1,000	300	300	5,000	-		
	-	500	22,900	4,250	50,000	30,000	4,000	20,000	6,500
		3,500	30,000	4,500	60,000	20,000	32,000	30,000	10,000
		10,000	55,000	2,000	75,000	25,000	70 Gesapax 8%	10,000	8,000
		11,000	60,000	2,[illegible]00	80,000	30,000	85,000	15,000	10,000

TABLE 5 Estimated volume of 1970 demand for

(Source : Alvin A. Thompson, Caribbean

	Dalapon 85% Na Salts lbs	2,4-D LV esters 5.03 lb ae/ US Gln US Glns	2,4-D HV esters 6 lb ae/ US Gln US Glns	2,4-D amines 6 lb ae/ US Gln US Glns	'D' + 'T' 50:50 4 lb ae total/US Gln US Glns	2,4,5-T LV esters 6 lb ae/ US Gln US Glns	Tordon 101 ¼ lb Tordon 2¾ lb 2,4-D US Gln US Glns	Actril D ioxynil + 2,4-D LV esters US Glns	Actril M ioxynil + 2,4-D LV esters US Glns	Asu 50 5 1 Imp US
Sugarcane	161,000	20,000	700	4,580	1,000	-	-	3,500		
Bananas	30,000	-	-	50	-	-	-	-	-	
Citrus	30,000	200	-	200	-	-	-	-	-	
Coconuts	10,000	200	-	100	50	-	-	-	-	
Coffee	4,000	-	-	150	-	-	-	-	-	
Cacao	1,000	-	-	-	-	-	-	-	-	
Pastures	4,000	500	100	50	4,150	250	175	-	-	
Non-crops & other crops	10,000	1,000	200	50	300	350	25	-	-	
1970 TOTAL	250,000	22,000	1,000	5,000	5,500	600	200	3,500	-	
1971 TOTAL	280,000	25,000	500	6,000	7,500	1,500	300	5,500		3
1974 TOTAL	150,000	16,000	2,000	3,200	10,000	2,000	2,000	15,000		10
1975 TOTAL	80,000	13,000	2,000	3,500	5,000	1,000	2,000	20,000		11

TABLE:: 6

Caribbean Community Imports of Pesticides for the years 1969 - 1973

Source: Compiled by statistical Section of Caricom from National Trade Reports

L.D.C. IMPORTS

599-02 INSECTICIDES, ETC., FUNGICIDES, DISINFECTANTS		QUANTITY					VALUE - EC $				
		1969	1970	1971	1972	1973	1969	1970	1971	1972	1973
ANTIGUA	Total	98716	3024	NA	-	-	99801	4981	-	-	-
BELIZE	Total	675900	774200	NA	-	-	630278	731060	NA	-	-
DOMINICA	Total	-	NA	-	-	-	333062	NA	-	-	-
GRENADA	Total	NA	-	-	-	-	-	-	-	-	-
ST. VINCENT	Total	NA	-	-	-	-	-	-	-	-	-
ST. LUCIA	Total	2,201992	1898023	2273352	2020179	NA	704891	614604	595989	721417	NA
ST. KITTS-NEVIS-ANGUILLA	Total	107557	139922	88328	153973	NA	113701	132946	110583	176360	-
MONTSERRAT	Total	NA	17857	18798	-	-	NA	41906	30763	55014	42485
INSECTICIDES											
TRINIDAD & TOBAGO	Total	1364699	2061370	595958	1028738	693311	1401884	2231681	1086306	1854326	1367308
	Caricom	42608	18	751	3302	9885	22049	88	2292	7373	6030

TABLE 6 CONT'D

INSECTICIDES (cont'd.)		QUANTITY - LB					VALUE EC $				
		1969	1970	1971	1972	1973	1969	1970	1971	1972	1973
BARBADOS	Total	668138	528775	534453	594,860	NA	523657	593420	643670	741434	NA
	Caricom	10285	32932	31908	32232	-	1526	19786	25237	27208	-
JAMAICA	Total	1637455	1472080	NA	1865281	17915308	1940314	1754,290	NA	2082226	4768198
	Caricom	13040	10752	-	22086	88650	10843	934	-	20400	86623
FUNGICIDES											
TRIN'D. & TOBAGO	Total	172170	125378	86752	78545	208167	187907	111,938	84290	79728	255059
	Caricom	-	-	-	-	550	-	-	-	-	1503
BARBADOS	Total	25548	4622	14747	50620	NA	48691	12172	17181	73728	NA
	Caricom	-	-	10950	17700	-	-	-	1090	1595	-
JAMAICA	Total	282030	1046388	NA	457967	725427	322718	943814	NA	582794	1281521
	Caricom	-	61	-	-	-	-	113	-	-	-
INSECTICIDES, ETC. FUNGICIDES, DISINFECTANTS											
Guyana	Total	1928150	1421047	1526516	1803450	NA	1196228	1132729	1421152	1633904	NA
Caricom		58840	142609	68305	73232		24364	41328	16158	31298	

TABLE 7 Barbados imports of Pesticides Total for the years 1969 - 74
(Source: Ministry of Trade, Industry and Commerce, Barbados)

YEAR	1969		1970		1971		1972		1973		1974	
Commodity	Quantity lbs.	CIF val	Quantity lbs.	CIF val.	Quantity lbs.	CIF val.	Quantity lbs.	CIF val.	Quantity lbs.	CIF val.	Quantity lbs.	CIF val
Insecticides	668,138	523,657	528,773	593,420	534,453	643,670	594,860	741,434	642702	871623	502730	971688
Fungicides	25,548	48,691	4,622	12,172	14,747	17,181	50,620	73,728	26312	15518	47800	109718
Weed-killers	515,182	547,048	485,490	622,545	449,073	620,546	713,854	844,559	622981	770380	661316	473942
Vermin Killers	19,159	17,846	15,411	15,598	14,491	12,321	28,522	18,785	18738	17329	N/A	N/A
Disinfectants	172,049	80,022	254,733	153,798	232,771	148,939	262,705	221,763	277445	294596	423786	308,344

TABLE 8

Volume of annual demand for individual pesticides in Guyana (1969 - 1975), with projections (1975 - 1980)

Pesticide	Unit	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Endrin 2% Pellets	lbs	59518	30013	29625	30924	58275	45500	45500	45500	45500	45500	45500	45500
Zinc Phosphide 3% Pellets	lbs	1960	3080	280	1550	4800	1725	1725	1725	1725	1725	1725	1725
Thallium Sulphate 2% corn Bait	lbs	418	352	418	552	473	638	418	418	418	418	418	418
BHC 13% gamma isomer	lbs	42168	37152	31556	38758	18574	62720	79341	77275	85002	93502	102852	113137
Triazines 85% WP	lbs	-	-	4901	15860	45859	239873	313040	336000	336000	336000	336000	336000
Malathion 60% EC	gls	1896	1358	766	1990	1891	1500	1725	1725	1725	1725	1725	1725
Trichlorphon 80% WP	lbs	3770	-	6506	4740	9295	13519	11597	14347	15697	17197	18797	20617
Monocrotophos 60% W.M.C	gls	-	-	779	850	1109	2329	3062	5012	7487	11199	16757	25119
Dieldrin 20% EC	gls	219	231	879	976	1658	4323	3439	3580	3650	3728	3813	3907
Propanil 30% EC	gls	-	-	408	400	900	376	5487	7956	10343	13440	17480	22724
Fenitrothion 50% EC	gls	4	-	634	1000	2000	2405	8270	13645	20467	30700	46050	69075
Aldrin 40% WP	lbs	-	-	3357	2310	10000	9000	11200	14000	15400	16940	18634	20497
Carbaryl 85% WP	lbs	1652	-	8542	-	30000	40000	40000	50000	55000	60550	66550	73200

Table 9 Estimate of Plant size required to Manufacture Products in acceptable period

Type and name of Pesticide	GUYANA Demand 1975				Projected GUYANA Demand (1980)		
	Major item of equipment	Volume to be processed	Time taken by major equipment	Estimated manufacturing Time	Volume to be processed	Time taken by major equipment	Estimated Manufacturing Time
Herbicide WP							
Triazines	Mill A	313040 lbs	626 hours	21 weeks	336000 lbs	672 hours	22.4 weeks
Insecticide WP							
Trichlorphon Aldrin Carbaryl	Mill B	62797 lbs	126 hours	4.2 weeks	114314 lbs	229 hours	7.6 weeks
Insecticide DC							
BHC gamma	Mill B	79341 lbs	159 hours	5.3 weeks	113137 lbs	226 hours	7.5 weeks
Liquid Products							
Malathion EC Monocrotophos WSC Dieldrin EC Propanil EC Fenitrothion EC	80 gal Jacketted Pan 'C'	21983 gls	44 days	9 weeks	122550 gls	145 days	29 weeks
Field Strength Dusts							
BHC dust	Ribbon Mixer D	2062866 lbs	920 hours	37 weeks	2941562 lbs	1313 hours	52 weeks
Rodenticide Pellets							
Endrin Zinc Phosphide Thallium Sulphate	Pelleter E	47643 lbs	95 hours	4 weeks	47343 lbs	95 hours	4 weeks

TABLE 10 Analysis of Sample of Kaolin from the Ituni deposits

English Clays Lovering Pochin & Co. Ltd.

Registered Office and Head Office:
John Keay House, St. Austell, Cornwall, England. PL25 4DJ

Telex: 45526/7 Telephone: St. Austell 4482 (STD 0726)

Telegrams: "Universal St. Austell Telex"

Directors:
Lord Aberconway (Chairman)
A. N. G. Dalton (Managing Director)
Professor N. O. Clark
R. L. Gale
T. A. Shelton
R. G. Meade-King
B. M. Grime
T. G. Pleasants
A. B. Cooper

R. L. Gale (Secretary)

ACTION
JUL 3 1974
MR. TRISCIUZZI
MR. SEARS
☐ ACTION COMPLETED
☐ ACKNOWLEDGED
☐ NO ACTION REQUIRED
INITIALS
(CCF) No. 03539
File: CA 321 GUY - 7

Our Ref: GLP/MCC Your Ref: CA 321 GUY (7) Date: 26th June, 1974

(Ce. Ter)

T. Trisciuzzi, Esq.,
Chief,
Section for the Americas,
Technical Co-operation Division,
United Nations,
P.O. Box 707, A-1011,
Lerchenfelder Strasse 1,
A-1070 Vienna,
Austria.

- 4 JUL 1974

GUYANA - TS/GUY/73/001 - Establishment of a National Pesticide Formulation Industry

Dear Sir,

We have carried out the analysis on the sample of clay with the following results which are compared with a clay which is sold for this type of application.

	Physical Properties ex U.N. sample	Comparative sample
Residue on 300 mesh	3.5 wt %	0.04%
Weight of particles greater than 10 microns	20%	19%
Weight of particles less than 2 microns	30%	43%
Moisture	0.6%	-
pH (of 10 wt % suspension)	4.2	4.5
Oil adsorption	38.7 g/cc	40.0

contd/...

GLP

Mineralogical Analysis

	W.H. Sample	Comparative Sample
Kaolinite	98	85
Mica	1	15
Quartz	-	-
Feldspar	-	Trace
Gibbsite	1	-
Anatase	Trace	-

Chemical Analysis

SiO_2	45	47
Al_2O_3	40	38
Fe_2O_3	0.84	0.88
TiO_2	0.74	0.09
CaO	0.02	0.03
MgO	0.02	0.13
K_2O	0.06	1.60
Na_2O	0.10	0.21
Loss on Ignition	13.9	12.45

The results show that this sample has a high kaolinite content with little impurities.

The particle size of the sample, although coarser than the comparative sample should be quite satisfactory except for the high 300 mesh content. We have not analysed the 300 mesh residue but usually it contains a much higher percentage of impurities, for example quartz, which would make the clay abrasive and cause wear problems in the formulation process.

In summary therefore the basic physical and mineralogical data suggests that this clay should be quite satisfactory as a carrier but that the product would be improved if the 300 mesh residue could be reduced.

contd/...

In view of the small sum of money involved in carrying out these analyses we have decided to make no charge for the work carried out and hope the results and comments will be useful in making your assessment.

Yours faithfully,

G. L. Toms
Research & Development

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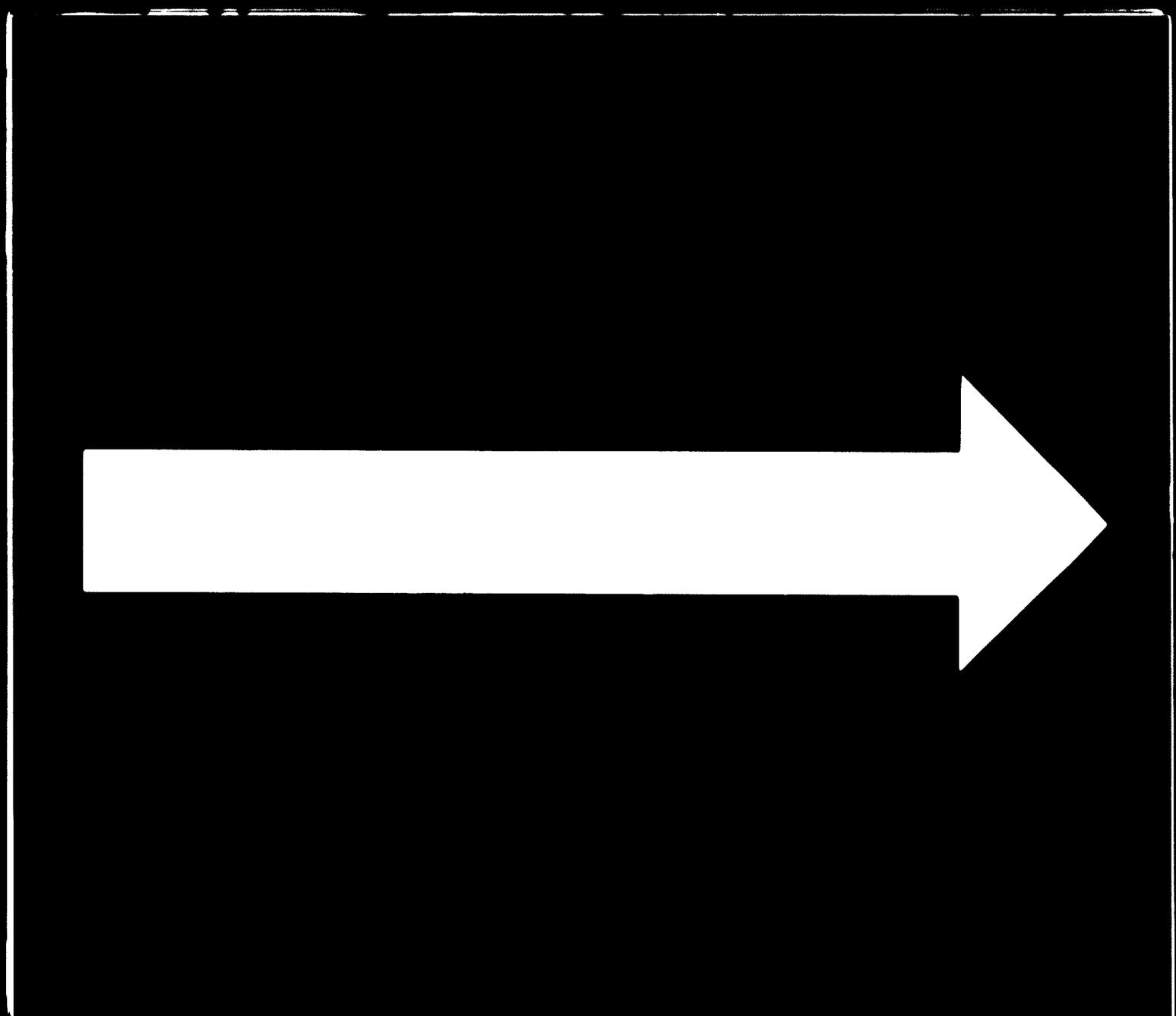

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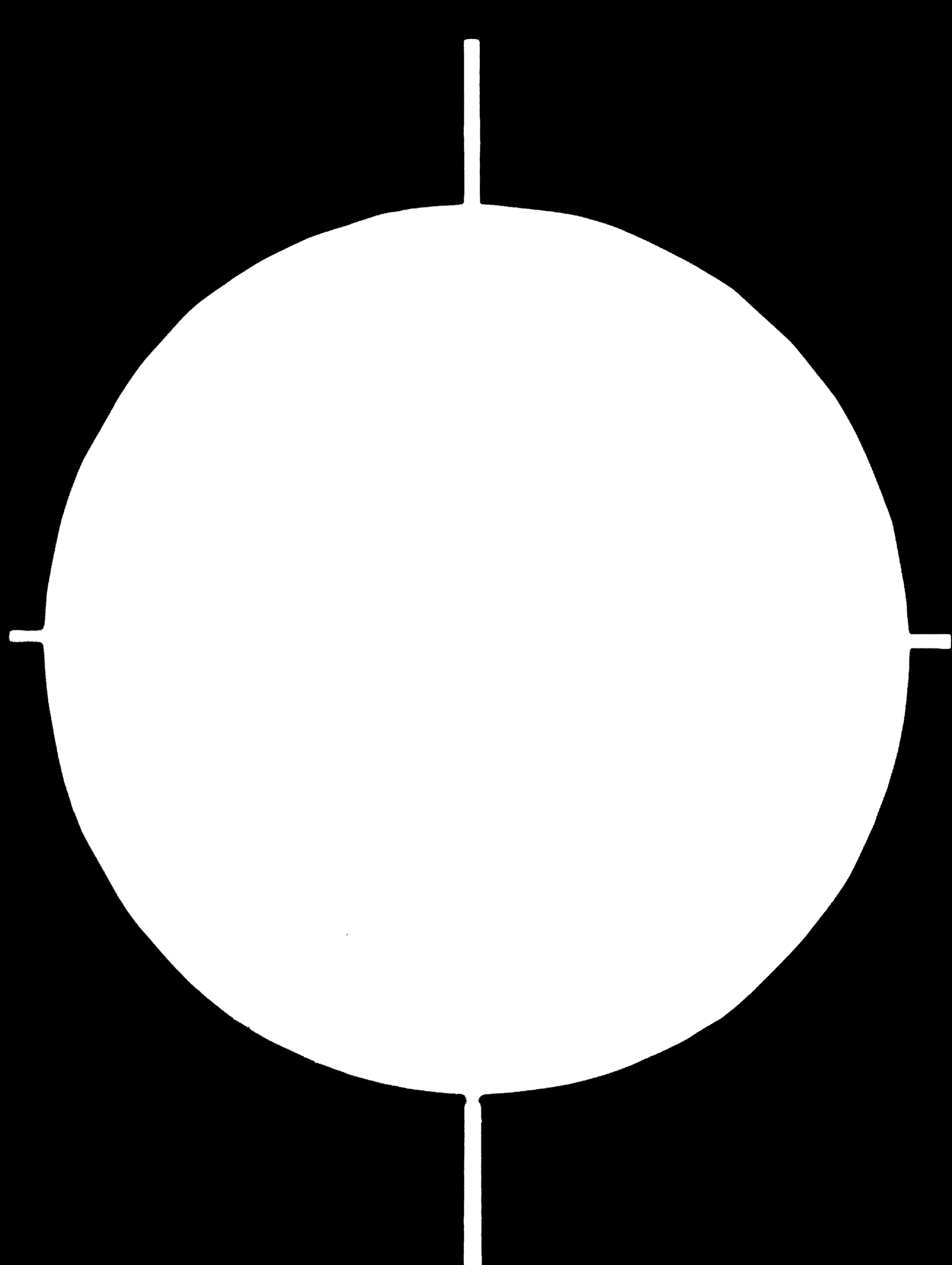
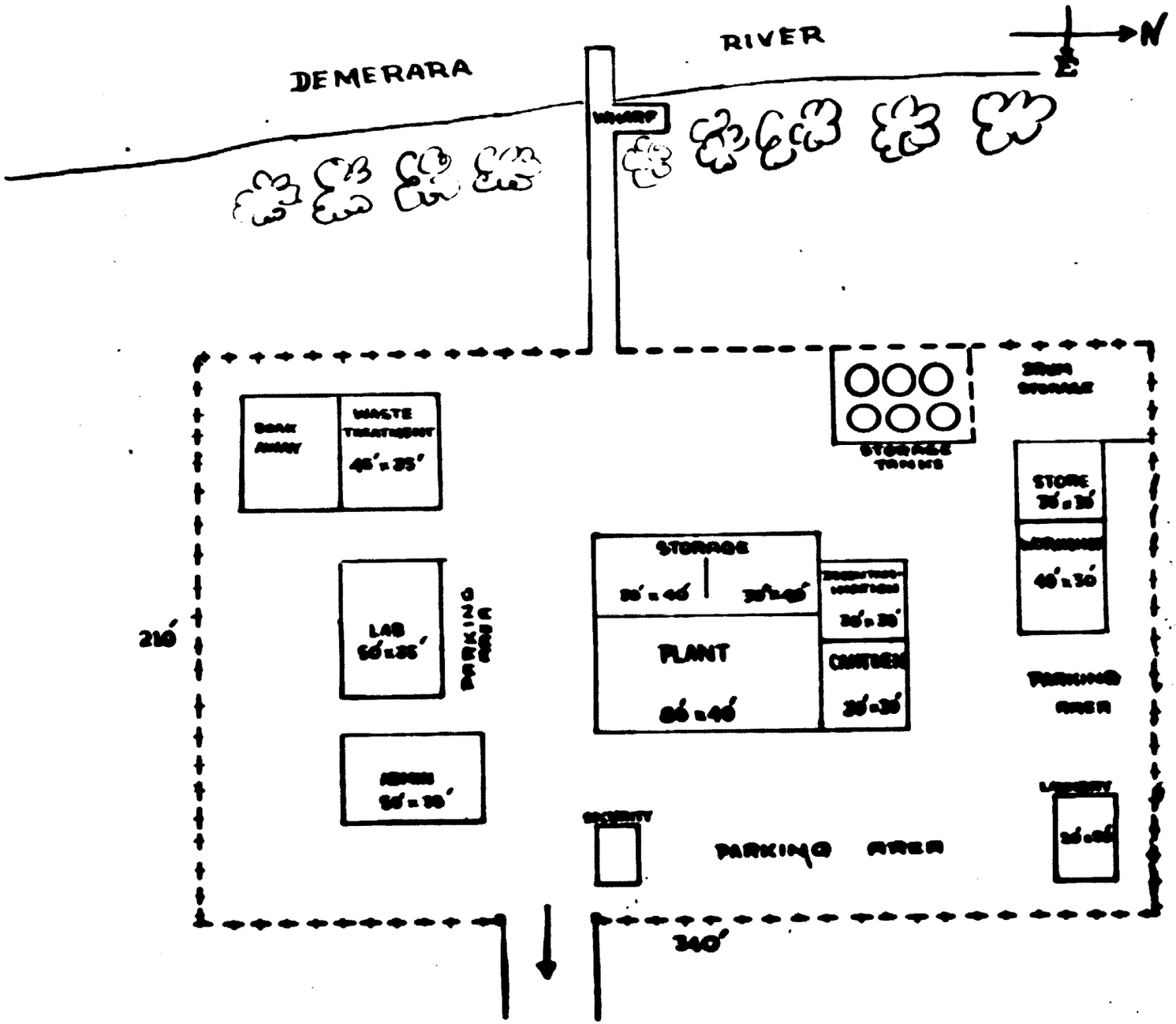
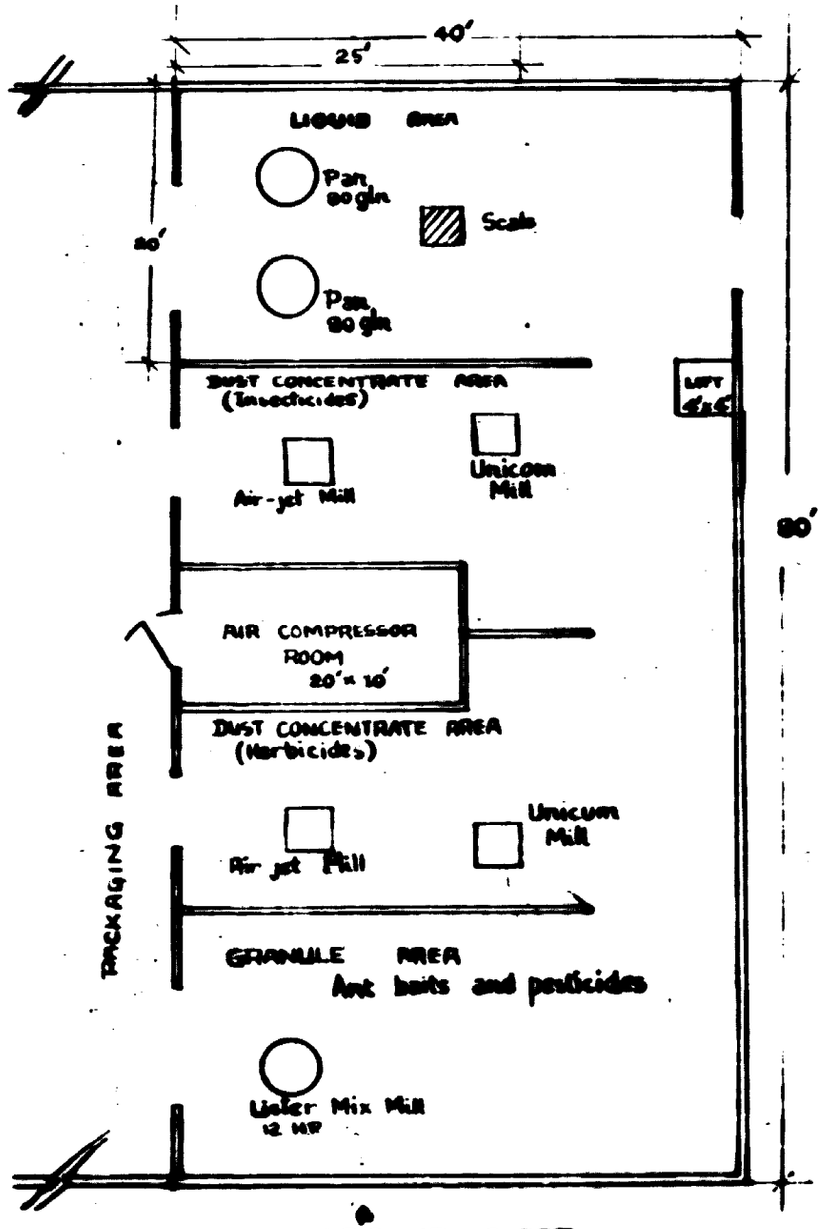




ANNEX 3

Fig. 1.
TYPICAL LAYOUT OF PESTICIDE FORMULATION PLANT COMPLEX

(Site A)



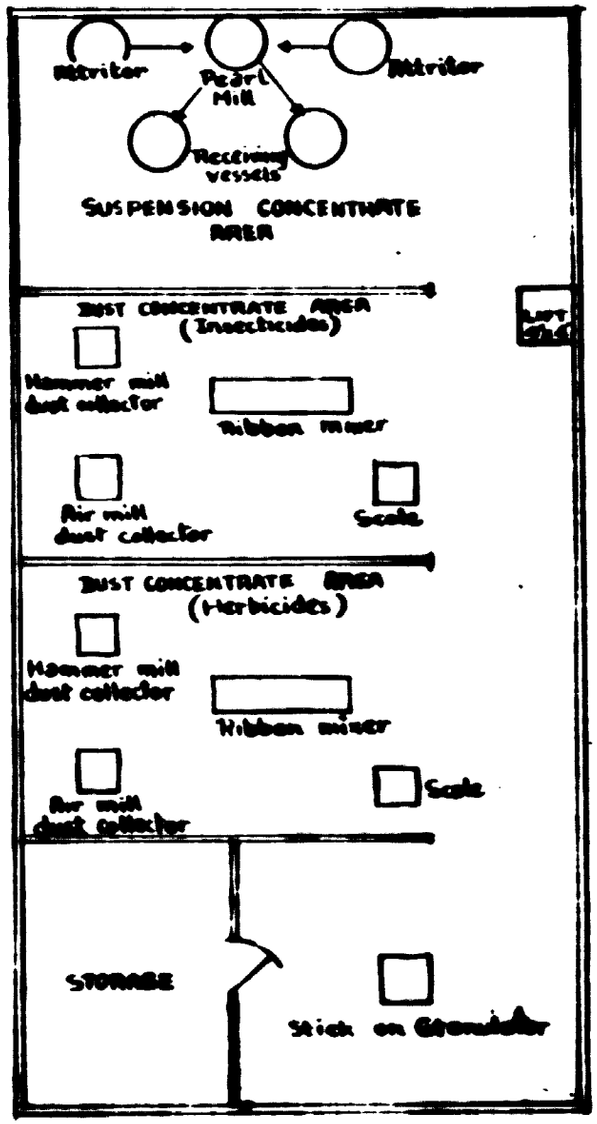


FIG. 2.
LAYOUT
OF
PESTICIDE
FORMULATION
PLANT
AREA

Scale 2mm = 1 ft.

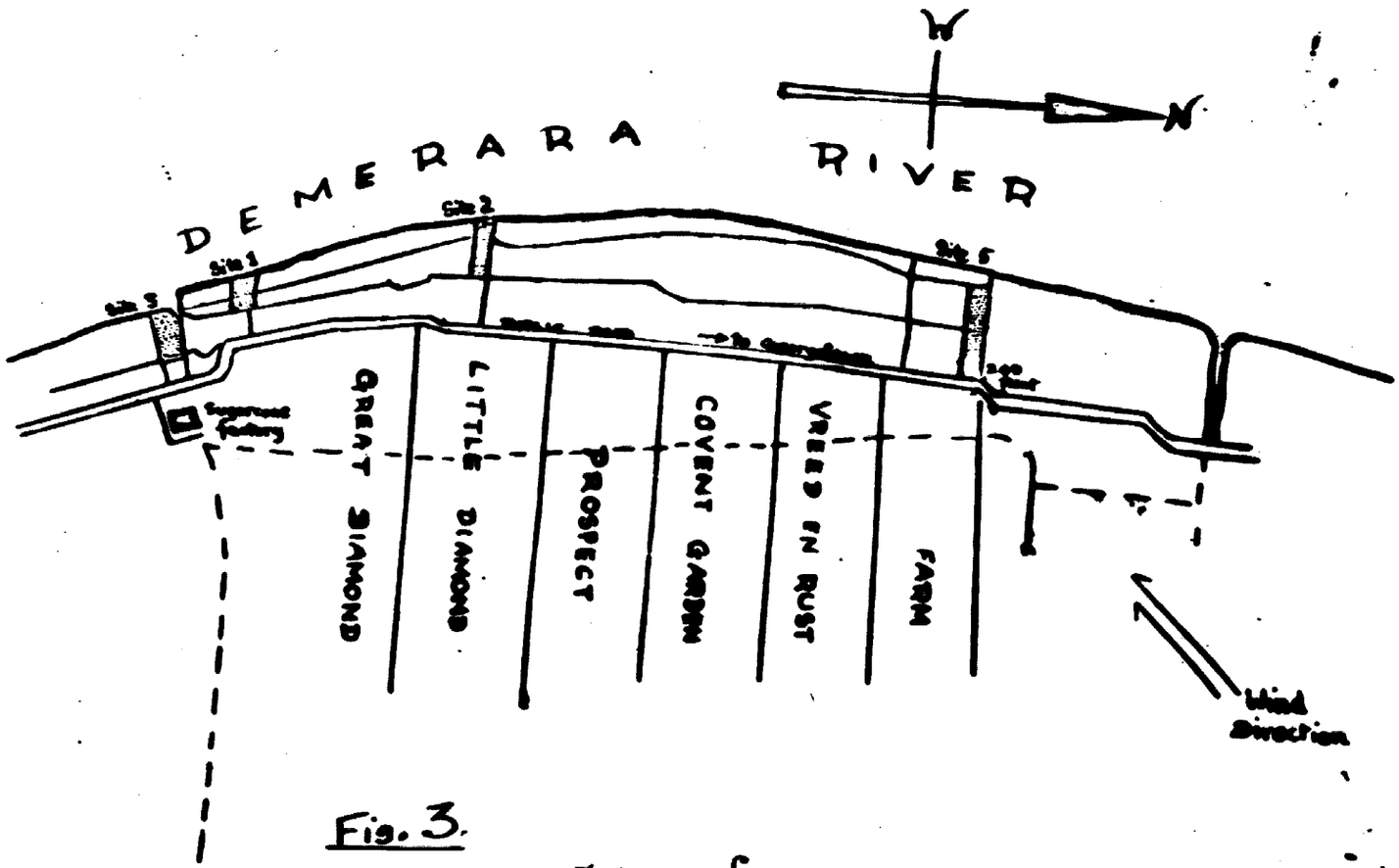


Fig. 3.

Possible Sites for location of Pesticide Formulation Plant.

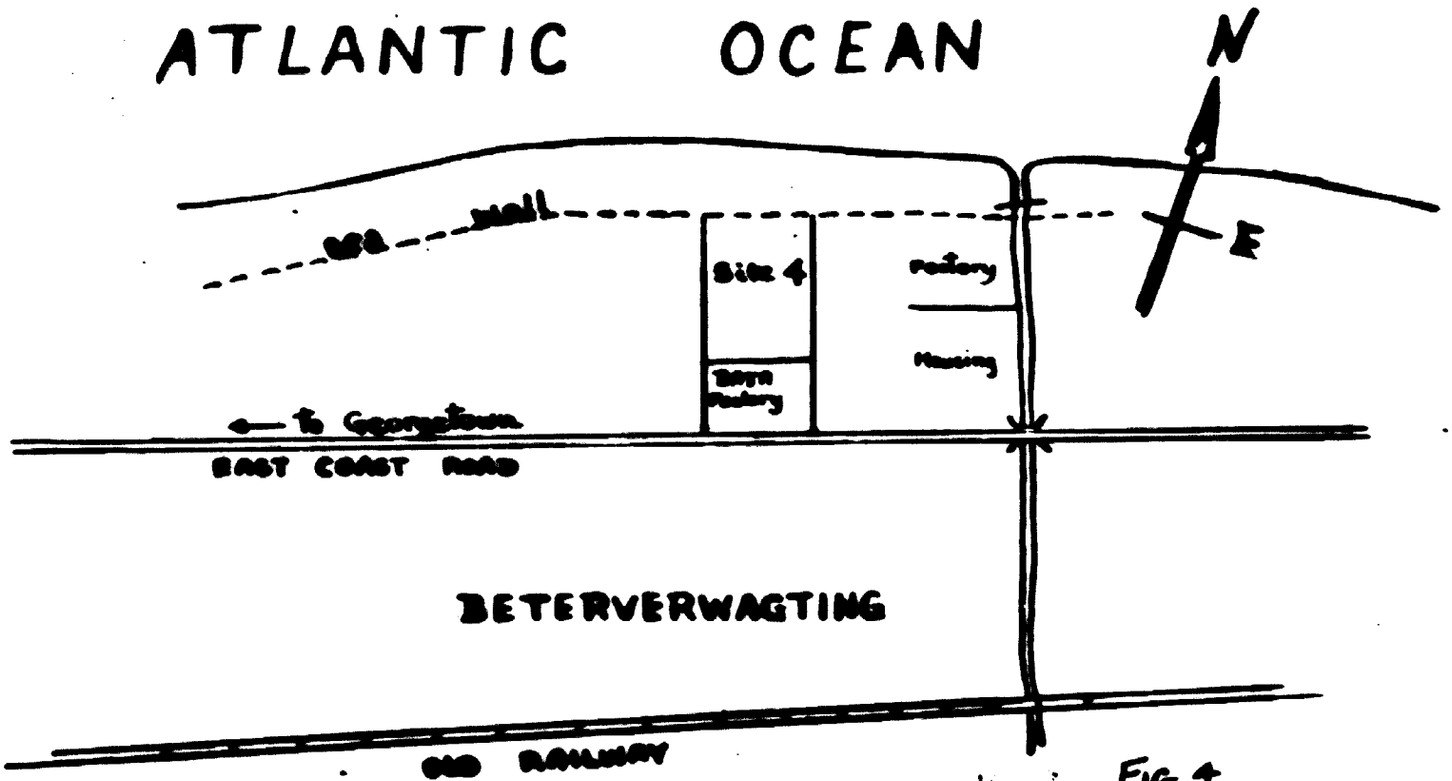


FIG. 4.
Possible Site for location of Pesticide Formulation Plant

ANNEX 4

NAME AND FUNCTION OF PROJECT COUNTERPART

Name of Counterpart: - Mr. K. Croal

Function: - Head of Plant Quarantine Division, Central Agricultural Research Station, Mon Repos, Guyana.

Starting date of counterpart's assignment - 21st May, 1975

Concluding date of counterpart's assignment - 1st August, 1975

Mr. K. Croal was appointed counterpart by the Ministry of Agriculture on the understanding that they could only spare him to carry out these duties for 4 days a week and that he would spend the remaining 1½ days carrying out his normal duties as Head of Plant Quarantine Division, Mon Repos. This arrangement has been adhered to.

Mr. K. Croal has been most helpful in providing the expert with local knowledge concerning the relevant Agriculture of Guyana and in arranging meetings with officials.

ANNEX 5

REFERENCES

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4. Agricultural chemical usage in the West Indies Sugar Industry. Annual Report West Indies Sugar Association Chapter 6, 1973.

5. F. Weihrauch and J. Ghansam, Ministry of Energy & Natural Resources, Geological Surveys and Mines Department, Georgetown, Guyana 'Brief information on Guyana Kaolin Resources' Unpublished, December 1974.

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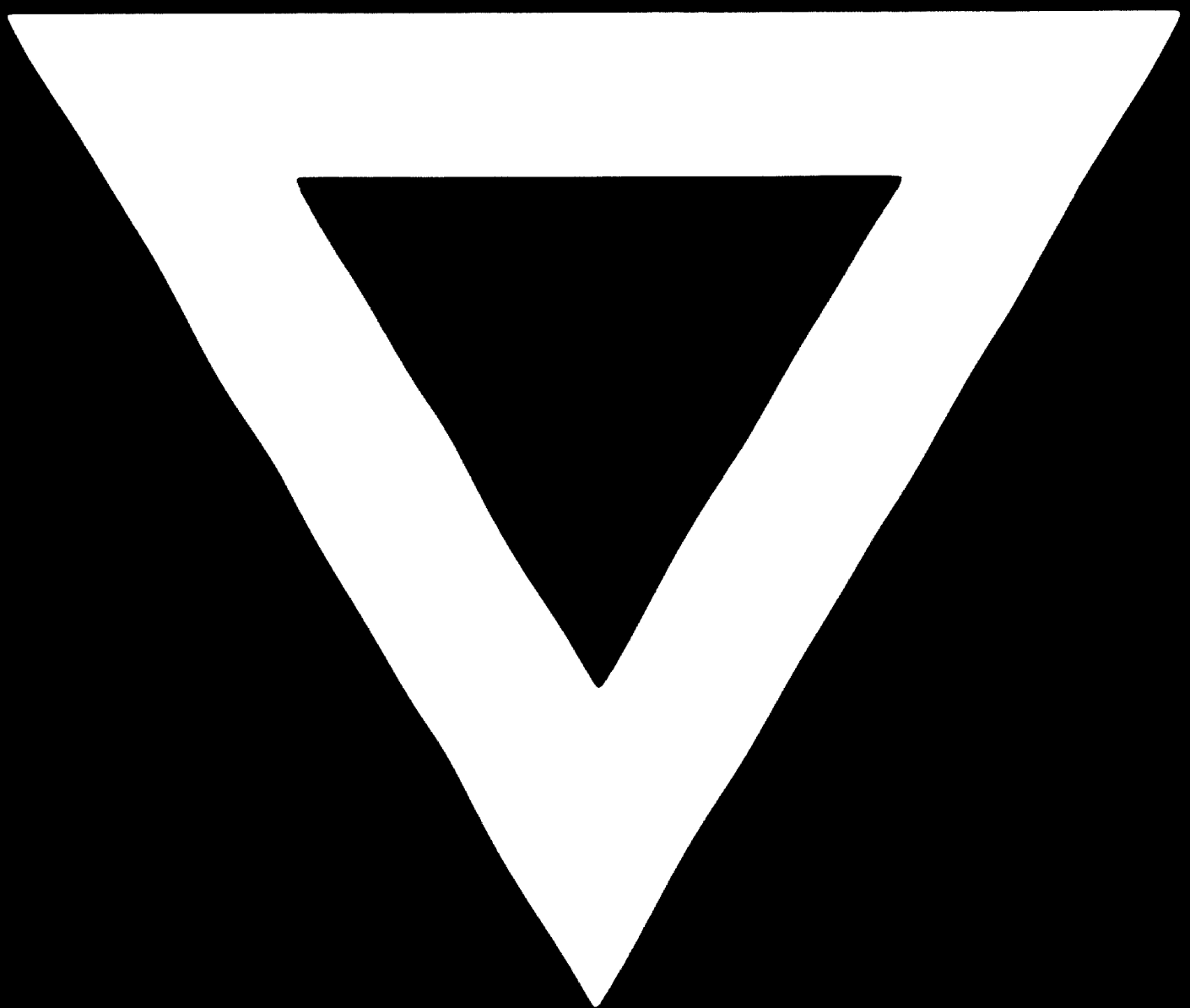

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